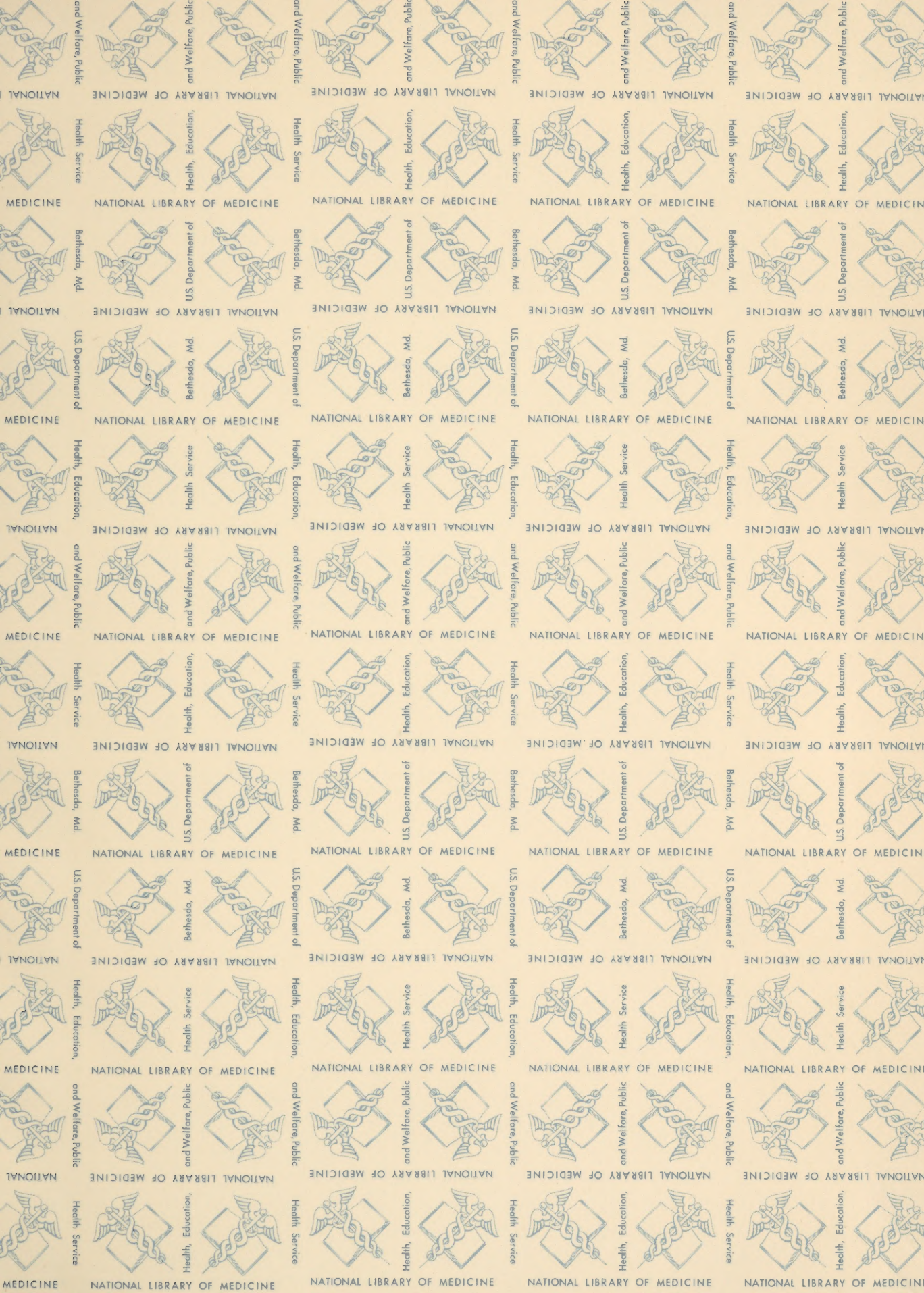
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Proc. Milit. Ophth. Meet.

PREFACE

Crile General Hospital feels honored in having been chosen to act as host to the recent Military Ophthalmological Meeting on 28, 29 and 30 November 1945.

The Ophthalmological Staff of Crile General Hospital wishes to thank Col. Gouverneur V. Emerson, Commanding Officer, Crile General Hospital, and Col. Clifford V. Morgan, Executive Officer, Crile General Hospital, for their invaluable assistance in making this meeting a success and the publication of this volume possible.

Most grateful appreciation is also extended to Lt. Col. M. E. Randolph and Lt. Col. Trygve Gunderson, the Ophthalmological Consultants for the Surgeon General's Office, Washington, D.C., and to Lt. Col. R. P. McDonald, Executive Medical Service Branch, Air Surgeon's Office, Professional Division, Washington, D.C., and to Lt. Col. Norman D. Hall, Chief of the Surgical Service, Crile General Hospital, for their many services, enthusiasm and unlimited cooperation during the preliminary and active phases of this program.

GILBERT C. STRUBLE, Lt. Col., M.C.,
Chief, Eye Surgical Center,
Crile General Hospital,
Cleveland 9, Ohio.

Military Ophthalmological Meeting. 1st, Cleveland, 1945

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WEDNESDAY MORNING SESSION

November 28, 1945

The first session of the Military Ophthalmological Meeting convened at the Crile General Hospital, Cleveland, Ohio, at nine-ten o'clock, Lt. Col. Gilbert C. Struble, Chief, Eye Surgical Center, Crile General Hospital, presiding.

CHAIRMAN STRUBLE: The meeting will come to order.

Gentlemen: I should like to introduce Colonel G. V. Emerson, the Commanding Officer of Crile General Hospital, who will speak to us at this time. Colonel Emerson?

COL. G. V. EMERSON: Colonel Struble, Members of the Staff and Visitors: I just want to take a brief amount of time to extend greetings and hearty welcome to the visitors at this meeting. We feel very fortunate that you have selected Crile for this important conference and a very fine program has been prepared. I feel that it will be an important contribution to the work done on surgery of the eye and it will be a valuable addition to the history of the Medical Department when this session has been compiled.

We trust that your stay here will be pleasant and that we will have the pleasure of meeting all of you individually as time goes on.

CHAIRMAN STRUBLE: Thank you, Colonel Emerson.

At this time, gentlemen, I should like to introduce Lt. Col. N. D. Hall, Chief of the Surgical Service, who has been instrumental in assisting us in many ways in making this meeting possible. Colonel Hall? (Applause)

LT. COL. N. D. HALL: On behalf of the Surgical Service, I wish to extend a sincere and hearty welcome to all of you. We at Crile feel honored that this meeting is being held here and we are proud of our Eye Section. With such an illustrious group gathered and so much talent, I know that your meeting is going to be most interesting. If there is anything that we can do to make your stay here more pleasant, we shall be glad to do it.

... Announcements ...

CHAIRMAN STRUBLE: I think it would be more interesting if we have a different chairman presiding at each session, and with your permission, gentlemen, I should like to name Colonel Cutler the chairman for the afternoon; Colonel Randolph for tomorrow morning's session; Colonel McDonald for the afternoon session tomorrow; Colonel Fox for Friday morning; and Colonel Burch for the afternoon session on Friday.

... Introduction of members present ...

... Colonel Struble then read his prepared paper on "The Use of Tantalum and The Ruedemann Eye Implant in Orbital Reconstruction with Presentation of Cases."

In June of this year, Colonel Derrick T. Vail, the Ophthalmological Consultant for the Surgeon General's Office, became interested in the Ruedemann type eye implant, particularly for the correction of severe orbital injuries. He named Dr. Ruedemann as the civilian eye consultant in this Eye Surgical Center to assist in this work. Dr. Ruedemann has donated a great deal of his own time, as a matter of fact approximately one day each week, for the past two months. He has furnished all the tantalum used and is responsible for the development of the tantalum mesh, paddles, sutures, wool and of the implant eye. We wish to give Dr. Ruedemann the entire credit for this development and to thank him for his excellent cooperation and for the many courtesies he has extended this department.

The implant eyes used by us have been developed from models worked out and perfected by Dr. Ruedemann who will later discuss this matter personally. Our eyes have been processed by Captain James Clifford, Chief of our Acrylic Eye Department, who will demonstrate the technique to those of you who are interested.

It was apparent at once that many problems confronted us in this work, which were not present in civilian patients. The chief of these factors was some way by which we could previously determine orbital measurements and orbital volume in those cases requiring correction. This fact was brought home to us early in those first cases where an implant eye was placed in the usual manner. In a few of these cases, the implant globe dropped down and back and almost disappeared except for the visible anterior segment. On two occasions in which a glass ball implant had been previously placed in tenon's capsule with little or no benefit - later X-ray studies showed these implants to have dropped below the level of the orbital floor and to be lying in the maxillary sinus and pterygoid fossa. This problem was discussed with Lt. Col. Emory L. Shiflett, Chief of the X-ray Service here. Col. Shiflett has developed a method of orbital tracings and measurements so that it is now possible to tell in advance exactly how much increase in the orbital diameter in any meridian is present. These tracings are now performed routinely on every patient prior to operation and we feel we are now in position to approach these cases surgically with confidence. The value of these tracings and measurements was particularly brought out in one case which to superficial examination appeared idealy suited to this procedure. Col. Shiflett, however, demonstrated to us that, owing to a complete loss of the posterior orbit and of a part of the squamous portion of the temporal bone, brain tissue was lying directly under the conjunctiva. Obviously, operation in this case would have been disastrous. Col. Shiflett will discuss this work later in the program. I wish to take this opportunity of thanking him for his splendid cooperation in this and other work associated with our department, and to state that without his cooperation, this work could not have been developed.

At first, we believed it might be possible to adjust for the increased or decreased orbital volume by using a larger or smaller sized implant eye. In two cases, an eye 27 mm. long was used to correct a severe depressed deformity. In both instances, the eye appeared proptosed after operation. In another instance, where it appeared a shallow eye was necessary, an eye 22 mm. deep was used, and we ended up with an enophthalmos. It appears, at the present time, that with few exceptions, a standard eye 24 mm. in diameter and 24 mm. long, slightly tapered posteriorly and beveled at the upper and lower margins is probably the correct size.

In cases where a mistake has been made in the size of the eye used, it is a relatively simple matter to remove this globe and to insert another of the proper size. The appearance of the socket during the exchange of eyes proved very interesting to us. The inside of tenon's capsule, in which the globe rests, becomes smoothly lined with what appears to be pseudo-mucous membrane throughout its entirety. Dr. Ruedemann has previously called attention to this fact and on microscopic section has demonstrated this lining to consist of endothelial cells.

It was the suggestion of Dr. Ruedemann that the element tantalum be used to make up the difference in volume where the orbital diameter was increased and to thus elevate the implant eye to its normal position and relationship with the other eye.

In our early series, we used tantalum wool for this purpose. At the present time, we are using tantalum mesh which we feel is even more satisfactory. This preparation developed by Johnson and Johnson to Dr. Ruedemann's specifications, lends itself extremely well to this work. Strips of this metal mesh can be cut to any desired size at the time of surgery, rolled up and placed in the floor or lateral aspect of the orbit to bridge over and correct any defects present. These materials in our expefience have been extremely well tolerated. In many instances, the post operative reaction, where tantalum packing has been utilized, has been less than that following some ordinary enucleations. Many of these eyes require adjustment after insertion. In fact, I would say it is the rule rather than the exception. For this reason, we have developed implant eyes with two paddle holes, one in front of the other, to facilitate the advancement or recession of any of the four rectus muscle slips should this be required. This is a very minor surgical procedure which can be performed under local anesthesia.

We feel this is a worthwhile procedure in those cases of moderate to severe orbital deformity for the following reasons:

1. It is a procedure strictly for the ophthalmologist.

2. It can be used in cases of contracted sockets where there is a deficiency of conjunctiva and thus save the patient the

necessity for extensive mucous membrane grafts to the socket. A conjunctival lining of the upper and lower lids is still necessary and there must also be sufficient conjunctiva in addition to be pulled over the ends of the muscle insertions to prevent exposure of the external and internal paddles.

3. Good movement of the prosthesis is possible if the muscle has not been too severely traumatized or the nerve innervation destroyed.

4. Secretion and discharge is reduced and may be definitely less marked than in those cases where the ordinary glass or acrylic prosthesis is worn. I am unable to definitely explain this but it may be a result of the fact that there is no dead space between the prosthesis and the conjunctiva to collect secretions and possibly because the prosthesis does not move or rotate around in the socket and, thereby, produce irritation and drainage.

5. Sagging of the lower lid and the depressed sulcus of the upper lid is greatly diminished or preventing entirely by restoration of the normal orbital volume.

In our present series of approximately 20 cases, all except one have been performed on sockets in which the eye had been enucleated or eviscerated previously. In most instances, many months had elapsed since the original enucleation. In those cases where a stump of eyeball remained, it was, of course, removed both as a safety factor and to facilitate the insertion of the implant eye.

In our early series, we performed these operations under pentothal anesthesia. We now feel this is unwise and that intratracheal ether is the anesthesis of choice. Most of these cases have fractures through the floor of the orbit and, during the orbital reconstruction, the leakage of blood into the antrum, nose and larynx, is apt to produce a severe laryngospasm if pentothal is used. We are applying a snug pressure dressing for about ten days after the operation. These patients have all received 200,000 units of penicillin in divided doses each 24 hours by intra-muscular injection for a period of from three to seven days depending upon the post-operation reaction.

Up to the present time, we have found three cases out of 22 who do not tolerate the acrylic implant eye. In these three instances, the implant eye was extruded after various periods of time up to three months.

In such a case, it is a very simple procedure to remove the implant eye and immediately fit the patient with a standard reform eye. If desired, Tenon's capsule can be reopened and a glassball implant placed in the usual manner.

Some deficiency of conjunctiva may be noted in such a case due to absorption or atrophy of the margins of the conjunctiva around the implant. If the pseudo-mucosa, which forms around the implant, is utilized, adequate space is present in the socket for the placing of a standard refrom eye in these cases. If the conjunctiva is again approximated, some traction on the upper and lower cul de sacs may be expected and a mucous membrane graft may be required to restore the size of the socket before a standard prosthesis can be worn.

Addenda: 14 January 1946. Since the above report was submitted, 6 more of the implant eyes have been removed because of extrusion or because of increasing general irritation due to sensitivity to the acrylic eye.

Because of this high incidence of irritation to the acrylic implant, the author believes that this procedure should be limited only to those cases where other standard procedures have failed.

Dr. Ruedemann, in a personal communication on this subject two days ago, informs the author that since he has been covering the posterior portion of the implant eye with tantalum mesh, he has, in large part, avoided these complications.

... Lt. Col. E. L. Shiflett, Chief, Department of Radiology, Crile General Hospital, presented a paper on "The Use of Orbital Tracings as an Aid in Reconstructive Surgery of the Orbit," as follows:

We have a number of patients with badly comminuted fractures of the orbital and facial bones who are undergoing reconstructive surgery of the orbit and being fitted with the implant eye.

Successful reconstructive surgery and proper fitting of the implant eye depend to a large extent upon restoration of the orbit, either by replacement of fragments, removal of fragments, or substituting tissue or material for lost bone tissue. The correct total diagnosis of bony deformities is shared by the radiologist and often is dependent upon him almost entirely.

The surgeon is often handicapped in the operating room by having only flat X-ray films on a view box available for reference. These are inadequate to guide him unless he has a clear and fixed mental impression of the deformities from previous stereoscopic studies of these films. There are also individuals who suffer extensive damage to the internal orbit from high explosive fragments without evidence of fracture of the external orbital wall. Unless this is appreciated and all cases X-rayed pre-operatively to determine the presence or absence of this damage, the proper fitting of a prosthesis is probably doomed to failure, because of increased orbital volume.

Col. Struble stated some of these difficulties to the Radiological Service and asked if there was any way by which the total extent of damage to the orbit might be portrayed in the interest of better reconstruction and a more adequate fitting of the implant eye. We considered many ways of attempting this and finally chose the simplest way which suggested a practical and workable solution to the problem, and began orbital tracings, and were surprised and pleased with the efficiency and workable accuracy of such a simple procedure.

Stereoscopic postero-anterior films in chin-nose position, the nose and chin resting heavily on film, and steroscopic laterals, injured side down, are made. Films are processed in the usual way. They are studied stereoscopically and pseudo-scopically, and under stereoscopic vision the normal and abnormal bone structure is traced on the film with an indelible pencil, using the normal orbit as a guide. After all fractures are identified, defects in orbit created by the fractures noted and traced on the film, the right-sided film as theindividual faces the stereoscope if right-handed, the left-sided film if left-handed, the film with tracing is removed and placed upon an ordinary view box. Upon this is superimposed a piece of clear transparent paper, and the tracing is recopied on the paper. We find architectural blue print tracing paper the best because of its great transparency and durability. This may be done with pencil or ink. We find the ordinary tracing pen and India ink quite satisfactory. Enough of the face is included to permit the appreciation of facial symmetry or asymmetry. The vertical and horizontal meridians of the normal orbit are measured and noted and compared with increased or decreased dimensions of the involved orbit. The combined anteroposterior and lateral tracings convey to the surgeon the three dimensional defects which can be appreciated by verbal consultation or by a short descriptive report. The graphic and written report are sent combined. It can then be taken to surgery for refresher reference at any time needed. After reconstructive surgery, the procedure is again performed without reference to the pre-operative tracing for checking of accuracy. It is, indeed, gratifying how nearly the two tracings duplicate each other, which speaks well for its accuracy and for accuracy of evaluation of the injured orbit by the radiologist.

It might be said that the radiologist benefits from this procedure for it demands accurate study, and probably results in a more accurate report than the written description of findings. In complicated fractures, it is sometimes necessary to make the original film tracing with different colored pencils to indicate the different depths, planes and relationships of fragments.

Col. Struble also mentioned that in some individuals difficulty was encountered in fitting the superior paddle by reason of impingement of paddle and prosthesis against the superior orbital wall. We undertook a study of the orbit in the lateral planes in an effort to determine if possible the cause of this difficuly. Fifty unselected cases on which Sweet localizations had been done were used for this investigation. The globe was reconstructed in the orbit by using the

horizontal plane of the cornea and the anterior position of the cornea as fixed planes, as established by the first Sweet exposure of the localizing film in which ball and cone are superimposed. A sphere with 25 mm. diameter is constructed, so that the anterior surface is exactly 10 mm. from the ball and the diameter corresponds to the projected horizontal plane, as established by the Sweet apparatus. All other planes in reference to facial and orbital physiogomy are construed from the horizontal axis of the globe. We feel that this establishes a workable accurate relationship of globe to orbit and bones of the face which enter into surgical relationship to orbital reconstruction. We have found, so far, that orbits fall into three types: One the anophthalmic eye in which the vertical plane of the summit of the cornea lies well posterior to the orbital floor, and constitutes 42%; the exophthalmic type in which the summit of the cornea lies on an average of 4 mm. to the anterior surface of the orbital floor, constituting 32%; and a third type in which the summit and anterior margin of orbital floor are flush, a type we have not so far designated. The types are definite, unmistakable and subject to wide variables. The anophthalmic eye is subject to the largest variables of its orbit and appears to be placed in the largest orbits. The supra-global space, that is the distance from the crest of the globe to the roof of the orbit, in the averages, vary little, but this space in the anophthalmic eye varies from 2.5-13.5 mm., while that in the other types is considerably less, being 4 and 5 mm. It might be that the clinical application of these criterea might prove of value if used consistently pre-operatively in all cases. The study emphasizes to us that, although there may be averages of the orbit, the variable in individuals is great and the only approximate normal is the opposite orbit. These studies also suggest to us that a defect in the orbital floor, irregardless of location, will affect the position of the globe or an implant by reason of periglobal tissue prolapsing through defect and pulling globe with it, thus disturbing the planes of the globe or implant.

We do not claim the accuracy of this as axiomatic. We do feel, however, that this gives sufficient accuracy to be used as a surgical guide. We do not offer these findings as definite opinions, but wish to point out that definite possibilities of importance to the reconstructive surgeon are promised. These studies are simple to perform, require little extra time, and can be performed by any radiologist and, given the films, by the surgeon himself.

We now show you one of the tracings, and since they will be shown with each case this morning, you can determine whether or not they will be of value to you. The other study is demonstrated in the exhibit booth. Time does not allow for further description.

... Presentation of cases by Lt. Col. Struble and Lt. Col. Shiflett ...

DISCUSSION ON THE USE OF TANTALUM AND THE IMPLANT EYE
IN ORBITAL RECONSTRUCTION

DR. A. D. RUEDEMANN (Chief, Department of Ophthalmology, Cleveland Clinic Hospital and Civilian Eye Consultant, Crile General Hospital): I would like to make a few remarks in regard to the development of this acrylic eye.

In the first place, I am like a hen with a bunch of ducklings. These ducklings have gotten away from me, in that they have marched out from under me here, and Shiflett with his tracings of these orbits, and Struble and Scheie and Croll and the rest of them used to take me for a ride out here. I was glad to get out from under them. The first day I would come out, I would work on the first patient, and that always would be the worst one. Then we re-arranged it. I thought I would take the second patient, and then that was the worst one. I found out they had a system with the anesthetists, where it wasn't always the same patient on schedule.

We started with this acrylic eye some two years ago. We got a lot of industrial work in which the eyes and orbits were burned out by acid and alkalis and by hot metals. In attempting to reconstruct these with mucous membrane grafts and skin, one finds that they are most unsatisfactory.

I started by using acrylic implants with tissue over them and putting them in the orbit, and leaving them in there as long as we could. Sometimes we would leave them in for a period of three, four or five weeks. We found that most orbits tolerated acrylics. That is not true of every orbit.

Acrylics are all plastics of the same type. They now have some two thousand formulas for plastic material. One hardly knows which of these formulas one is getting in the eyes at the present time. As a matter of fact, in the eyes that they are making for us, they now use four different types of plastic in one eye. So you see if you say, "Well, you must neutralize the substance of which this plastic is made," you may be leading yourself astray.

The truth of the matter is that 80 per cent of the orbits will tolerate plastic, and another 10 per cent will tolerate the plastic if it is boiled a long while, as Captain Clifford is doing here.

A dental surgeon told me that when he was making plastic teeth, he soaked all his teeth in vinegar for 48 hours. Since we have used this maneuver, we have had no acrylics that were intolerable. I don't believe that is going to be 100 per cent true, however. We might as well face the issue that all people will not tolerate acrylic implants, nor will they all tolerate reformed eyes made out of plastic, nor do all people tolerate glass eyes. So you are not going to get 100 per cent results on this or any other method.

I am sure that this is not the final story in the business of putting in acrylic prostheses. I think we are going to get a better way out of this and that we will get better results. After all, we have only been doing it for two years. If you talked about putting these things in permanently, you probably would run into some difficulty later on by slow extrusion from the socket perhaps.

If one takes this business of orbital prostheses and divides it into three parts, one finds that in the first group are the simple enucleation group, and I have a movie on that, so I won't talk about it.

The second group is of those with the reform eye where they lose acuity, by virtue of the fact that the upper lid is constantly pressing down on the reform eye, and presses the lid out. You can go into these sockets and pick them up, take tenon's capsule, and by opening up, make four muscle slits, and plant one of these implant eyes inside tenon's capsule. You require very little muscle to get good muscle movement. As a matter of fact, if the patient moves about ten degrees with the other eye, directly with the other eye, not lagging, it will require very little more movement to get the entire appearance.

You must remember, when you are doing orbital plastic work, that the result that you desire is not always the result that the patient desires. You may not be satisfied with it. It is sometimes advisable not to talk too much in front of the patient about how that eye looks. It is not always wise to say to your associate, "It looks like hell to me," because it may look perfectly all right to the individual who has to have it.

I have a case in point of a chap who had his orbit burned out with hot metal. We planted an implant eye in there and it did not looksatisfactorily to me. I wouldn't have it around for ten minutes, but I tried to talk him into another operation and he said, "What's the matter with it? Aren't you satisfied with it?" Of course, I had to back out very fast, because we were having a terrible job to get the thing in, in the first place, and to get it to stay in, in the second place.

So with prostheses you have to be ready to let the patient set the standard by which you are going to go. Often monkeying with them and trying to make yourself satisfied with them will spoil your end result.

The third group is the group Colonel Struble showed here this morning - those in which you have orbital destruction.

If you remember your cases of exophthalmos, enophthalmos is exactly the opposite. In exophthalmos, only two things can happen to the orbit, diminution in the orbit's size or increase in orbit volume. There are no muscles or tissues in the orbit that push the

eye up, back or down. If you have diminution in size or increase in volume, you have exophthalmos. The eye has no place else to move but forward.

In enophthalmos, you have just the opposite. You have increase in size of the orbit or diminution in orbital volume or orbital tissue, and then you get enophthalmos. In this last group, we had enophthalmos or we had an increase in orbital volume by virtue of both loss of tissue and increase in orbital size.

If you remember back, in all your cases, we have tried to replace orbital volume. You cannot replace orbital volume just by merely replacing the volume in the eyeball itself. We have tried that.

I have with me three different sizes of eyes that we have evolved. If you want to do an orbital implant on someone who had his eye taken out as a youngster, then you must use an eye that is smaller than the opposite eye, or they will not match up. The orbit is definitely small. That is where Colonel Shiflett's work has come in so prominently for me, in that we did not realize in our simple enucleations or simple replacement of the eye, that the orbital volume may be definitely smaller by virtue of the fact that the individual had the eye removed earlier in life. We have a case in point out there now, where we had to go back and definitely put in a smaller eye.

In regard to the eyeball shifting, I feel that most of our shifts are due to the fact that the orbit is beginning to diminish in size. It may be advisable that we review this group. We are now trying to place a tantalum sleeve or tantalum covering on the back of our implants in order to allow the tissue to grow to the implant and hold the implant in place without the use of tantalum paddles.

This is another change in the process, but I think for the type of eye that we are showing here this morning, the tantalum plates with the tantalum wire and the tantalum mesh make the best procedure.

It is not possible that all of us have these patients and all of them get good results. They are difficult to do. Colonel Struble did not tell you this. They are difficult to do. They require a tremendous amount of patience and a lot of study beforehand.

If I may suggest one thing, it is that you get rid of your remorse by knowing what you are doing before you do them, because they are a terrible headache afterwards if the eye is out of place or if you have to go back in the socket the second time. I can assure you that I have spent hours and hours, both here and at home, trying to put these eyes where they belong, and I for one am not satisfied that this is the final story in these acrylic implants. I think that we can do a better job, and I am sure that out of a meeting like this all of us will learn a great deal, and I may find out that we are entirely wrong.

...Dr. Ruedemann passed out samples of tantalum mesh and acrylic eyes...

... A motion picture on Operative Technique was shown, and the following are a few of the comments made by Dr. Ruedemann during the showing:

I have a couple of little stunts. One that I don't know where I picked up, is to buttonhole the conjunctiva and then with an old Stilling knife go around and cut the conjunctiva, then put a pinchers clamp on and again, with the Stilling knife, cut off the muscles, because you get a much better cut with the Stilling knife. Now, these muscle plates are attached by merely sewing through and through to the under side of the muscle.

The wires are attached to the muscle plates, first, before operation; and merely by going through the muscle and out, one attaches the muscle plate to the under side of the muscle, gaging it so that the anterior portion of the plate will be covered by part of the pendulum.

The last stitch that goes through is locked. We have changed this technique so many times that the artist has refused to make any changes until we are finally settled on one method. You will notice that this will be locked. I don't know why, except that it keeps the wire fastened.

This wire is hard to handle. It is very brittle, but once it is put in, you can depend on its staying there. You must bury the ends. The ends are sharp and have sharp points.

The original cords were put on to hold the eye. After the plate is attached, the paddle tip is turned over and put into the paddle hole, and then the wires are passed through the holes that are made in the acrylic eye. If you work with tantalum wire, you will find that you have to tie it close to the knot. The wires will break off as they did four or five times yesterday. Then you braid the wire and with the braided edge, you turn the braided end down into the hole. You bring tenon's capsule over, and then you bring the conjunctiva over tenon's.

It isn't always possible to bring tenon's capsule up over the muscle. It isn't so easy to dissect it out. There is one thing to remember, the more dissection you do with tenon's capsule, the more likely you are to get poor balance of the levator muscle. We do very little dissection.

Interestingly enough, we found out from this procedure that the levator muscle actually is a muscle that is divided into three planes. One plane goes on to the eyeball. One plane goes to the tarsal cartilage, with its superior aspect, and one plane goes to the skin. If you approach the levator by going to the outside, you may only get the levator fibers going to the skin. You must approach the levator muscle by going through from underneath. If you do a recession of the levator in the case of exophthalmos, we have found out you have to go to the eye fibers in order to get a decent recession. Otherwise, the lid won't come down.

Art Coller has been working on the same prosthesis in the Navy and insists that the oblique should be attached. I can tell you it is a terrible job, in the first place, to put the attachments on, and in the second place, we had most of our trouble in those cases in which we did the obliques. To come back and pick them up is not easy. After all, the thing is enough of a headache without building up any more worries.

We can now build a tantalum mesh and put it on these plastic eyes and sew the muscle directly to the tantalum mesh. I think that procedure will eliminate the paddles eventually and allow for better placing of the muscles on the acrylic eye. It will eliminate about 10 or 15 per cent that are now sensitive to the acrylic.

I am not sure that soaking them in vinegar is going to be the answer, and I am trying to figure out in advance what is going to happen to it. As I said before, these eyes are not 100 per cent satisfactory. We have now a little over 100 of them put in the sockets, and only seven of them have had to be kept out permanently. Of those seven, two were in recurrence of orbital tumors. I think, perhaps, in our enthusiasm, we put one in, in one case where we should not have. In the other case, we went into an eye that had been enucleated seven years before, a very disagreeable looking socket. We went into that socket, opened it up, and put one of our implants in. A short while afterward, in a period of a month, the eye was being extruded and he had a recurrence of his tumor. I would not be a bit surprised if we stimulated a re-growth by going in there and putting the implant in.

If I may say just a few words in regard to this again, first, I think that the problem of their staying in the orbit is more or less solved. They will stay in.

The positioning of them I think is not going to be as serious, because you must correct it, at present, before you put your acrylic eye in, especially, if you have a divergent eye.

I think that when the people from the Army release their eyes to the civilians, the eyes will be better than the ones that we are dealing with. They will look better and probably won't fade as much. We are just now getting over our difficulty with fading. (Applause)

... The paper by Captain James Clifford, D.C., Chief, Acrylic Eye Laboratory, Crile General Hospital, on "The Processing of the Ruedemann Implant Eye" was not read, but Captain Clifford explained his display ...

The display depicts the procedure employed in the complete fabrication of the Ruedemann Implant Eye, beginning with the processed iris button, followed by the wax model with the button attached. The most commonly used mold 24x24 mm. made by investing the wax model in stone and coating the same with tin foil is the next step displayed. The processed sclera and body of the eye, including the iris button, or the rough eye, is next displayed.

The following steps carry up to the finished eye, excluding the attachment receptacles: Veining with rayon fibres, modifying colors, using 10% monopoly solution of different colors, and, lastly, the conjunctiva coat which is a clear layer of plastic 1½ mm. in thickness processed over the entire cornea and sclera.

The highly polished, completed eye, including the tantalum paddle receptacles, is the last step of the display.

The large eyes on display are used for display purpose only. All other eyes are practical.

DISCUSSION

LT. COL. N. L. CUTLER (Dibble General Hospital): I noticed that the implant that was sent around here had two different curvatures on the spheral surface. I was wondering whether you approximate the spheral curve to the approximate diameter of the eye on the other side.

Also, I want to ask if the amount of movement in these eyes has been measured in degrees to give us an idea of how the results are running.

About how many of these patients have to have some secondary procedure done. They do on the badly deformed socket, but on the normal enucleations, do you have to go in to change either the position of the eye vertically or horizontally or anteroposterially?

DR. RUEDEMANN: We get on the average 20 degrees movement nasally and about 25 to 30 degrees temporally. Superiorly, we hardly ever get more than 15 degrees, and inferiorly, it doesn't make any difference. It runs about 10 or 12 degrees by actual measurement.

As I said before, if the initial movement is made at the same time with the other eye, with the reform eye, the initial movement has a tendency to lag, and it is that lagging that gives the appearance of staring.

If the initial movement is initiated at the same time, it doesn't take as much movement as it would with a reform where the eye doesn't approach the same position. It is the lateral movement that counts mostly. The rest of the movement, the movement up and down, is covered by the lids very materially, so you don't notice that much, but the movement to the side, into the extreme outside, is the most important and movement less than 20 degrees is very noticeable. The eye has to move better than 20 degrees in order to get an appearance like the other one.

Surprisingly enough, you can go back into these old sockets and pick up old muscle stumps and attach the acrylic eye to these old muscle stumps and get nearly as good movement as you do in the primary enucleation. It doesn't change that story a great deal.

I meant to say one other thing but I forgot it. That was on the conjunctiva. Remember just one thing about the conjunctiva, and that is that it is no good. Don't depend on it for anything. It won't stay in position. It is the mucous membrane that cannot be used, and if you try to cover plastic eyes with it or try to cover metal with it, or anything else, it is sure to wear away very quickly and be of no value to you. So you must plan in all of these operations, as far as the conjunctiva is concerned, to exclude it and do without it as far as possible.

We had in our original plastic eyes the conjunctiva attached by a purse string around the cornea, and I frankly say that the first eye we put in is still in and looks all right, but the second and third one did not look all right because the conjunctiva pulled away from the cornea, and with the sensitivity apparently of the conjunctiva to the acrylic, it pulled away so far that you can see the holes that we put in to attach the conjunctiva to the eye.

So you should not depend on it, as these eyes are all made with an acrylic front. We could not use them if they were shaped exactly like the eye with the conjunctiva pulled over them.

The other question was as to how often it was necessary to make secondary changes. We never did any experimental work by planting these eyes in animals. We started planting them right in humans from the start.

Our total number of changes would amount to 30 per cent of the patients in our series of 101 people. Some of these changes were for fading of the plastic. Some of them were because the eye was too small. Our original eyes were far too small. We had an idea that we could take the muscles and slip them through holes and turn them back on themselves and that would act as a clamp, but they were too deep set.

DR. RICHARD G. SCOBEE (St. Louis, Missouri): I would like to ask Dr. Ruedemann if all the suture material was catgut, or did they use some silk.

DR. RUEDEMANN: We started out by using silk. Then we found it was unsatisfactory and that, due to the tissue fluid, the muscles would come loose. At least, we blamed the early failures on silk. Then we went to nylon which was just as bad as silk. Then we went to catgut, which is practically no good at all for this procedure. So we had to look around for another.

The trouble with both the tissue sutures was that they did not hold the muscle long enough. It takes at least two weeks. These eyes should be covered for at least two weeks, and most of the suture material is not effective over a two-week period of time.

With our tantalum mesh, we are going back to attaching the muscles to the tantalum mesh with catgut, in the belief that the muscle will grow to the tantalum mesh within the two-week period of time that the catgut is effective. Silk and nylon were of no value to us at all. They softened up and almost disintegrated in eight to ten days' time.

DR. SCOBEE: Do you use catgut on Tenon's capsule, too?

DR. RUEDEMANN: Yes, we do not use tantalum wire to close Tenon's capsule.

All the tantalum should be buried. When you get exposure of the end of the tantalum, you get discharge, due to one of two things: Either faulty position of the wires of the tantalum plate or sensitivity to the acrylic.

MAJOR TRYGVE GUNDERSON (Eye Consultant, Surgeon General's Office): I am very curious to know exactly what happens between the acrylic implant and the socket itself, whether you get a type of epithelium growing around it or whether you have a granulated tissue, or whether it becomes a fibrous capsule that is intimately connected to the acrylic itself.

If you probe the edge of the conjunctiva of Tenon's capsule between that and the acrylic, what is the situation there, Dr. Ruedemann? I am very curious to know.

DR. RUEDEMANN: One thing that worried us most, to start with, was what would happen in the orbit if we got infection in the orbit and got meningitis if we had a direct pathway. Fortunately, we had only two infections in our series of cases, and one we probably should not have operated on at all. The man had infection to start with, and we didn't take it into consideration enough when we put in the implant.

The other case was a late infection, coming nine months after acrylic implant had been placed. He developed cellulitis. We didn't do anything with the acrylic eye. We treated with some deep heat, penicillin, and let him go. He still retains his acrylic without any change at all.

We were surprised to find that this was more like endothelium lining than epithelium. It isn't epithelium tissue. It takes eleven or twelve days before the tissue forms around the acrylic eye. It does not grow into it. The tantalum plates and the tantalum wire will grow right into the tissue. The tissue will grow directly around

it and will accept it. It will not accept the acrylic eye as it does the tantalum.

In some of the early ones, where we attached the conjunctiva directly around the cornea, the conjunctiva in two or three instances grew up over the front of the plastic and gave the appearance of a keratitis. That was a rarity rather than the usual condition. In most instances, the tissue does not tolerate acrylic as well as it does the tantalum.

It is a pseudo endothelium lining and it forms rapidly around the eye. If the socket is not tolerating the plastic, this lining becomes very heavy in connective tissue and forms between the muscles and forms a bridge between them, and that is where the extrusion takes place. With the constant pulling back on the muscles and the tightening up of the endothelial lining, the eye is gradually forced forward and pulls the tantalum out from its attachments, but the tantalum itself grows into the muscle or the muscle tissue grows around it.

CAPTAIN A. E. SHERMAN (O'Reilly General Hospital): I would like to ask Colonel Struble a question. When you are putting in the tantalum wall - that is, the filling material - as I understood you put it in at the same time you put in the acrylic eye.

LT. COL. STRUBLE: That is correct.

CAPTAIN A. E. SHERMAN: How do you approach that? Do you work back through the muscle tone, put it along where you want it?

In the case that you showed, I wondered if a very satisfactory result would not have been obtained by simply using filling material. As I understood, you said he had plenty of room in his socket. In fact, he had quite a large socket, so it is more a matter of filling the orbit than anything else. I notice that the end result was not too satisfactory and he had practically no movement. I wondered, in cases of that type, if it would not be just as well to use filling material of one kind or another to build up that socket and simply fit them with ordinary cork eye or glass eye.

LT. COL. STRUBLE: In response to your last question, I think we could have used ordinary material, such as cartilage or possibly bone.

CAPTAIN SHERMAN: I didn't mean the material. I meant simply fill the orbit where you want to fill it out, and use the implant along the floor or any way you wanted to do it. Wouldn't it be a good enough socket so he could wear a pretty good ordinary orbit?

LT. COL. STRUBLE: Without some type of restoration of the floor and back of the orbit, I don't think he could have worn any type of eye. As a matter of fact, Captain Clifford saw this man and couldn't make any kind of eye for him. I see no reason why he could not have been reconstructed

with something other than tantalum just as well.

On the other question, as to how we place the material, we open the conjunctiva to the midline, dissect the conjunctiva down if the deformity is in the floor, or laterally if it is laterally, raise Tenon's capsule, free up the area underneath, and just place the tantalum underneath. That is all. It is very simple. The tantalum is almost like screen. It is cut in strips and you can roll it up to any desired size.

WEDNESDAY AFTERNOON SESSION

Lt. Col. N. L. Cutler, Dibble General Hospital, presiding.

THE NEW ORBITAL IMPLANT

... Lt. Colonel Cutler showed a motion picture...

LT. COL. CUTLER: There are two or three things about these cases that I might tell you. I think we have done 22 of them so far. We have to learn on human patients, and all the men on the service have done them.

Of these 22, we had to take two out because we used catgut sutures and they didn't hold, and we had to take two more out because we didn't have a firm enough bite on Tenon's capsule. That is important.

Twelve of them have been fitted with artificial eyes to date. The minimum lateral movement is 65 degrees, and the maximum is approximately 75 to 80, and the average is 70. Seventy degrees takes in the lateral movement between the edges of a pair of spectacles on an average person.

The vertical movement has been consistently 65 degrees; that is, we have measured them on the perimeter.

Of these 12 patients that have been fitted with artificial eyes, none has had any significant sinking in of the upper lid to date. Whether that will remain so or not, we do not know.

You want to bear in mind, of course, that these are not abnormal sockets. They are normal sockets.

There is no tendency for the lower lid to droop from the weight of the prosthesis, since the prosthesis does not rest on the fornix. In fact, the prosthesis is made as small as it can possibly be and still stay inside the lids.

Of course, the eye has to be properly centered by the artificial eye maker. The dentist who is making our eyes was making the ordinary reform eye or styloform, as we call it. He was making a larger diameter than the normal diameter of the eye. After a little bit of argument (you know how these dentists are) I got him to make them approximately 25 mm. in diameter, and in some cases we had him make them a little less, and in some cases a little more. It is a matter of judgment.

We are going to have these implants made out of chrome alloy throughout, and we think they can be made up more quickly.

You can adjust the position of the artificial eye in all directions. The implant is not always exactly facing straight ahead. Where that is the case, it can be taken care of in the fitting of the prosthesis.

... Major A. J. Kreft, M.C., Billings General Hospital, presented his paper on "Orbital and Ocular Injuries Produced by Modern War Missiles." (Applause)

This paper will be published in complete form by the Journal of War Medicine in an early issue.

Major Kreft discussed factors which influence eye wounds in modern warfare. He gave a classification of war injuries of the eyes and visual pathways, stressing particularly indirect ocular war injuries. LaGranges Law was discussed.

The ballistics of modern high velocity war missiles were presented as an explanation of the types of orbital and ocular injuries under discussion.

The following conclusions are taken from this paper:

1. Serious eye lesions, frequently macular in location, can be produced by blast concussion alone, without perforation of body tissues by missiles or other foreign bodies.

2. Equally serious indirect ocular lesions can be produced by the orbital penetration of even minute shrapnel fragments traveling at extremely high velocities without touching the globe.

3. To date, we have seen no instances in which severe traumas of the mandible alone have resulted in ocular injuries. It is possible that the temporo-mandibular joint may absorb some of the

concussion or at least direct the concussion away from the globe.

4. In our present series of cases of ocular injury, resulting from severe unilateral wounds of the facial bones, the eye injury has always been on the same side as the facial injury, and in all cases, the eye of the opposite side has been unaffected.

5. LaGranges Law holds for facial injuries produced in World War II, as in World War I.

6. All persons who have been exposed to severe blast or who have incurred war wounds of the head are entitled to a most thorough and painstaking examination of the eyes and visual pathways.

   (a) This should include a careful examination of the ocular fundus through dilated pupils. Particular care should be exercised so that a minute rupture in the fovea, peri foveal retinal or choroidal degeneration or a disinsertion of the retina at the ora serrata is not overlooked. All cases should have careful field studies made to be certain no defect has been missed. We have found it worthwhile to check the patients carefully for evidence of micropsia or macropsia by having them look at a dot placed in the center of a staff of parallel lines. Using this simple test, we have been able to determine the localization of a very minute perifoveal lesion which was almost invisible with the white light of the ophthalmoscope.

7. All cases enumerated above should have a complete radiological examination of the skull facial bones both orbits and optic foramina, for evidence of fracture or foreign body. In indicated cases, soft tissue radiograms of the orbits for evidence of very small and practically non radio opaque foreign bodies should be made, so that these tiny particles frequently overlooked on routine films, will not be missed.

LT. COL. STRUBLE: I realize that we wandered a little far afield on this. The reason I ran it in on the program here was because I thought it would explain some of these severe orbital traumas that we are encountering and that we are talking about today.

It certainly was an eye opener to me to know that the horsepower, moving effect, of a bullet, for instance, is over 10,000 horsepower. The weight of that mass of the missile is not the important thing. It is the velocity with which the missile transmits its force to the tissue, and when you realize that these little particles flying off high explosive shells sometimes come with a velocity of two or three times that of the initial velocity of a bullet from a rifle, we may have a wounding effect up to over 30,000 horsepower. That I think explains why we find a severe damage in the orbit, such as Colonel Shiflett has demonstrated to you thismorning - a

severe damage to the tissues and yet on X ray study of these orbits, we may only find a little tiny particle in this orbit.

THE USE OF DERMAL INSTEAD OF FAT IMPLANTS IN DEEP SOCKETS

MAJOR G. L. WITTER (Dibble General Hospital): Certainly, we all have had problems that are in common, and I think that it is fitting that at this time we just discuss briefly another type of implant which can be inserted in a very deep eye socket to minimize its depth.

The problem of the deep eye socket you are all familiar with, the boys we have had come to us wearing prosthesis that are extremely large, in fact so large that it is almost difficult to deliver them a prosthesis. The artificial eye maker is unable to make a sightly artificial eye for a deep socket.

The real object in our attack is that we minimize the depth of the socket, create again a superior and inferior fornix, provide a flat, or even better, a slightly convex posterior wall of the socket which will have a more positive contact with the prosthesis. In so doing, we eliminate the need for a large prosthesis. We eliminate a great deal of irritation which comes from such a large prosthesis.

... Major Witter showed slides illustrating cases ...

You have all tried fat and found it very unstable. You may have tried cartilage or bone. You may have tried many other things. We feel that foreign objects placed in the eye socket are very apt to be involved by new fibroblastic tissue and eventually a very fibrous capsule will be formed about them to which the adhesive bands connect and contract and cause these foreign bodies to migrate. We have not had a long time to observe these men, but it is not likely, as we see the problem, that the de-epithelialized skin will be connected to bands which, when they contract, will cause it to migrate.

This is an extremely simple procedure. A portion of the body, particularly the abdomen, the lateral portion of the abdomen, even the anterior chest wall, may be the site that you can take the skin from. You de-epithelialize the skin by using a Blair knife or Paget's dermatotome. The simplest instrument is the one to use. We use the Blair knife.

From that de-epithelialized area, an ellipse is obtained and is placed in warm saline solution until you have closed the abdominal wound. Following this, you prepare the socket for implantation.

We have been making a horizontal incision in the conjunctiva and a vertical incision in the Tenon's in order not to have the suture lines lying directly above one another.

After the incision is made in the conjunctiva, it is elevated well to the fornices and toward the canthi. Then the vertical incision is made in Tenon's capsule and it likewise is well elevated.

You then have a large piece of de epithelialized skin, about 40 mm. by 20 mm., which you may utilize to place in this socket in a quantity that will give you the amount of filling that you desire.

As we see it, it is one of the features that should be emphasized and that should speak well for skin as an implant. The previous preparations of bone and cartilage and metal and glass and acrylic require considerable thought and time, and very frequently turn out to be a bit too big or too small. The fact that the skin is so easily obtained, and you can cut the amount that you want and place it, seem to us two very marked factors in its favor. The amount of skin that you put in is definitely determined by how far forward you want the socket to come. You naturally want it to fill the lids to as nearly as possible the amount that an eye would fill the lids.

The way the skin is put in matters very little. It has been placed in, in layers, one layer on top of another. One rather long piece of skin has been rolled and placed beneath Tenon's, or one layer in itself has been found sufficient to do the job. It is well to fill Tenon's out as well as possible, that is, towards the frontices and toward the canthi. The Tenon's capsule is closed by using mattress sutures and slightly overlapping. The conjunctiva is closed by continuous suture.

The compression bandage is applied for a matter of four or five days, at which time the black silk sutures are removed. We have had only one instance where the skin was not accepted well. That patient had a marked scarring of the lower half of his socket, and in looking back on it, it was not an ideal case at that time to have attempted to open Tenon's. The scar was adherent to the inferior of the orbit.

There is no reaction to the skin. There is very little serious discharge following the implantation. Thank you very much. (Applause)

DISCUSSION

LT. COL. M. E. RANDOLPH: I would like to ask Major Witter if this method is used because the usual methods of bone or glass balls were not found to be practical. We haven't had any particular difficulty in inserting glass balls, particularly bone, as a secondary implant, at all.

I think that is a fine additional method, but I don't see the advantage of it.

MAJOR T. CAVANAUGH (Cushing General Hospital): Have any pictures been taken of the subject's flanks or chest wall or abdomen following the surgery? That is certainly gilding the lily, as far as I am concerned.

CAPTAIN B. R. SAKLER (Wakeman General Hospital): At Wakeman Hospital, we have used the so-called grafts for retracted lids following enucleation. I found that in using that type of graft, we got very, very nice results in filling up the upper lids. We never used the implants in the sockets, but the upper fold was filled out very satisfactorily following the enucleated eye.

By the way, we took the skin not from the abdomen or chest wall but from inside the arm.

MAJOR WITTER: To answer Colonel Randolph, about whether we were satisfied with other types, that was just something that we thought we would try, and it seemed to work out very well so we continued using it in twelve cases. However, it has been stated by many, and it has been our experience, that occasionally the formed implants do move.

As far as taking skin from the individuals, we have had no complaints from the boys on whom we have done it. Furthermore, it is rather interesting that the skin is simply closed by using subcutaneous form. The scars are at a minimum.

In regard to the reform implant, many men whom we respect very highly, and one in particular, gave up after three years of trying to make acrylic fit the prosthesis. Others besides Dr. Greear have expressed their opinion in the literature that reform implants do have a tendency to migrate. I am sure that they do not all migrate. It is very fortunate that they do not, because a great many of them have been used in the past.

Let us put it another way. That this is another medium of minimizing an abnormally deep eye socket; that if it is done with ease it does not cause any reaction in the conjunctiva or Tenon's, that there is a lot of it available, and borrowing it from the patient does him no harm. When you have it in your hand at the table, you can use the amount you want. Often that is where we lose out in placing reform implants in sockets.

One question that has not been asked, which probably should be, is: What happens to hair follicles? As the Captain mentioned, the plastic surgeon has used it in areas where there is movement for a long time. He has never worried about it. In the three months that we have observed our patients, we have seen no difficulty in the sockets.

CAPTAIN SHERMAN: I think possibly you are misquoting Dr. Greear's article. The only one I know of was the article in which he proposed using grooved glass spheres as implants, and in that article, he said that the ordinary spherical implants and spheres would occasionally migrate. I don't think he wrote anywhere that the grooved glass spheres had much tendency to migrate, occasionally, yes, but I think very rarely.

The grooved glass spheres that are on the market at present are somewhat a far cry from the original grooved glass spheres, and some that we have obtained have had very shallow grooves. They might just as well have none.

I think when you use a grooved glass sphere as a laid implant, with fairly deep grooves in it, there is very little chance of its migrating out of the muscle coat.

By the way, also in that operation of his, he said that he usually went right through Tenon's capsule. Usually in those cases, it is impossible to reopen Tenon's capsule, so actually I think you are putting the implant within the muscle.

We tried using acrylic implants before we could obtain the glass ones, and we were able to make those large grooves.

As far as the dermal graft goes, there has been occasional trouble with it, I am sure. I remember Dr. Wheeler's saying that he knew of cases - he also had tried it himself - where there was a late formation of cysts from sebaceous glands and so forth. There has been a fair amount of work done on that by Peer, of Newark, in which he buried dermal grafts and examined them microscopically as long as a year and a half later, and usually the epithelial elements that remain do undergo degeneration and are replaced by giant cells, fibroblasts, and finally end up as a mass of fiber tissue.

MAJOR WITTER: I would like to say that Captain Sherman's remarks are well taken. I wish he and Colonel Cutler would get together. I did read the article which was referred to.

LT. COL. CUTLER: You have me confused with Dr. Greear. Probably what you had in mind was that we have seen Wheeler's grooved spheres not in the place he put them. He never wrote a postscript to that article to that effect. However, I think that it probably is necessary to use whatever method you think is going to work with the equipment you have and the material you have.

As to the abdomen, there has been no problem. We have not felt there was going to be any later disadvantage. The matter of using a person's own tissue, whether you use fascia or derma or cartilage

or bone is, of course, a problem to bring up additional procedure on patient.

MAJOR CAVANAUGH: How soon do you expect to change the size of the prosthesis that you have used on these fellows? Would you be willing to estimate the time?

LT. COL. CUTLER: You mean for the final prosthesis?

MAJOR WITTER: About two weeks. In that particular picture the eyes had been shaped out ten days after surgery.

MAJOR CAVANAUGH: I mean, when are you going to enlarge them, not take them down?

LT. COL. CUTLER: The socket hasn't changed in four months so that we could change the prosthesis. The muscle coat is gone and so is Tenon's capsule. You just have some ill sorted scar tissue present. I don't think you have in many of these cases a definite space in which to put something with some certainty.

MAJOR CAVANAUGH: That brings up an interesting point. I had two fellows that were enucleated when they were children. One soldier lost his eye when he was seven years of age. He is twenty-four now. I wanted to find out whether you could put an acrylic implant in that type of individual. I told him I didn't think it would work, but to my amazement it split easily, went in easily, and slid up easily, and worked perfectly well.

If most of our patients are of the type that have had just a straight enucleation overseas and have come back without an implant permanently, I feel the only implant to use is an acrylic, unless you are going to use this new system.

LT. COL. CUTLER: The cases I have in mind are those where there has been severe laceration and I have gone in and found the Tenon's space in some cases, but certainly not good enough to find it on quite a few of them.

MAJOR CAVANAUGH: I mean just a clean-cut enucleation.

LT. COL. CUTLER: On a clean cut enucleation, I agree with you. We have only felt we would use this type of procedure in cases where you just don't have any, you just have a mass of scar tissue and a lot of that. We haven't been able to isolate Tenon's space in those cases, nor have we felt we were in the muscle coat any more than the general position of the muscle coat.

MAJOR GUNDERSON: I think it might be apropos at this time to mention one reason why glass balls do migrate. I believe it is a hangover from several articles that were written on implantation, one notably by Dr. Jersey and one by Dr. Verhoeff.

In their original descriptions, they placed sutures in the ends of the four rectus muscles and actually drew them over the front of a 16 to 20 millimeter glass sphere. If you place such a large sphere in the Tenon's capsule and draw the four rectus muscles over that and sew them tightly, they are bound to be under some tension.

I know that both of these gentlemen gave up that operation and failed to rewrite it. In my travels around this country and in the Mediterranean Theater, I found a great many eye surgeons were still attempting to draw the four rectus muscles over the glass ball which they were implanting. If you do that, I am perfectly sure that a great number of them are going to slip out between the four rectus muscles and become dislocated.

The obvious correction of it is to pay no attention to the rectus muscles at all, but simply to sew the free edge of the Tenon's capsule over the glass ball so that it lies with no tension whatever, either overlapping it or in one single thick layer.

I am perfectly sure that in my own experience, since I have given up this first operation which I described, I have had no glass balls migrate.

If we can correct that misconception by these few words, I think itis worthwhile.

MAJOR CAVANAUGH: For Major Gunderson's information, in February of 1917, Dr. Verhoeff wrote an article, telling how he did give up suturing the four rectus muscles and used the envelope flap he is using at the present time.

LT. COL. CUTLER: There is just one further comment on it, that is, that these cases in which this skin has been used have not been cases in which we felt there was a Tenon's space in which to implant something, and they did not have a ball in there or any implantation at all. There was apparent laceration.

... Colonel Struble asked Dr. Ruedemann to make some comment on Lt. Col. Cutler's presentation ...

DR. RUEDEMANN: All I can say is that it looks very good to me. The only question that arises is whether you replace the orbital volume or not. The trouble with the implant may start about at the end of two or three months. Regarding extrusions, our eyes have all been retained for the first two or three months.

I think this is an excellent method, and for primary enucleation, I think it is equal to the method we use, or perhaps better than the method we use. I can't say I haven't tried it. The movement is absolutely excellent. I think he is to be complimented on it because it offers one thing that we would have difficulty with, and that is the placement of the eye, if you have a tendency to retraction of the single muscle.

The procedure is logical and you just accept it. It looks like one of those things that ought to work.

If I may say one word about implants in general, over a period of some years we have tried every type of implant and have taken out all these various types of implants to put in these acrylic eyes. I don't know of any that doesn't work at one time or another. We have taken out glass balls, gold balls, bone, and the rest, and it seems to me that they are all tolerated by certain individuals at one time or another and that some of them are not tolerated at all. It seems apparently an idiosyncracy that the patients who will tolerate a gold ball won't take a glass ball. The glass balls, to be sure, are the ones that have holes in them, some of them, and are ruptured within the eye socket by secretions getting in to them, and we have them explode in the socket. So we have planted acrylic eyes, clear acrylics, within the socket and had the socket opened up so that you could look through the acrylic eye and see what was going on in the back of it and retain it in the socket for a year with a clear opening in there so we could watch what was going on within the socket. We have done the same thing inside of the sclera, using what was known as Burch evisceration, and taken off the cornea and put a clear acrylic inside the sclera and watched the eye. You could watch the tissue form on the optic nerve and arrest.

These are all tolerated in certain individuals, and in others they are not.

In contradiction to Major Gunderson's thought on not sewing muscle across the front of these, I don't think that makes a lot of difference. I think it is the way you finally close over in front of the implant, whether it is going to be retained or not, how much reaction that individual has to the implant, and how much connective tissue forms between the muscles, whether it is extruded or not.

We have done them both ways. We still sew some muscles over some of them, because the ones you sew the muscles over give you the best movement.

Going back to Dr. Cutler's implant, the only thing about the implants Dr. Cutler and I are doing is that we have gone one step further than this other implant, and some of them will stay in and some of them will not. It isn't going to make a great deal of difference how you put them in there or what you do as long as they stay in. I think he is to be complimented on this implant.

LT. COL. S. A. FOX (Newton D. Baker General Hospital): We have been using the acrylic implant now for about 160 cases, with the round ball with small indentations like the bone ball.

This is hard to believe, and I don't believe it myself, but we have had no extrusions. We use the ordinary two suture cross closure of Tenon's and an ordinary running suture. I wouldn't vouch for the movement and I wouldn't vouch for how long they are going to stay in, but we have had no extrusions. I don't know how to explain it except perhaps that we use the

snare in cases of enucleation instead of incisions. I am under the impression that we get less hemorrhage after the enucleation. We use a tight pressure bandage for five days.

DR. RUEDEMANN. I would like to ask one question. There must be some men here who do not put any implants in at all. Someone came to visit me and said, "Why do you put anything in at all? Why not close it over? You get just as much movement without it as you do with it." I think somebody must have some experience with that.

LT. COL. CUTLER: I might say one thing, Dr. Ruedemann. We used a different type of implant in about 100-odd cases, on which I sent a paper in awhile ago, called a bastard implant. We put in a hollow acrylic implant and pulled Tenon's capsule inside, so that eventually you had a socket which had a depression in the middle of the implant and completely covered over. Then I had a stud on the back of that which fitted into this hollow space, and we got an improvement on the movement, but when you draw the conjunctiva over your implant you have lessened the normal amount of space in the fornices and that puts actual limitations on the movement of the prosthesis.

We found that in some of those cases, because of the shape of the implant, we could get almost as good movement with a steel reform eye, because when that turned that shortened the fornix on one side and deepened it on the other.

It has been my impression, speaking of sockets without any implant at all, that the socket sometimes had a surprising amount of movement. If I remember correctly, Joe Friedenwald doesn't use one, or didn't use to.

I have also seen patients who had an implant put inside the sclera and had a movement which was practically the same as a normal eye so far as the stump was concerned, but it was not transmitted to the prosthesis to any degree at all.

The problem always seemed to me a question of transmitting the movement of the stump to the prosthesis without regard to whether you had an implant or not. We just evolved this method as being a method of actual mechanical transmission of movement.

DR. JOHN KEYES (Inactive): Dr. Ruedemann goes back into my ophthalmological history a little bit, in the days when we just used to take out the eye, period.

Incidentally, I saw a practitioner do that same thing last year. He just removed the eye, sewed the conjunctiva and quit. I followed the case through, and when the prosthesis was applied, I was surprised to see that the movement was not too bad. I, however, believe, from quite a few years of experience with spherical implants, that the patient should be given the advantage of the implant until such time as the present methods of Dr. Ruedemann and Dr. Cutler are available to us in civilian life.

I am very much interested to see how tolerant the socket is to dental acrylic material. I became interested in plastic material as demonstrated back in 1923 by Col. Sowers, and I was interested in using dental acrylic material in the sockets and in the prosthesis. You recollect that at that time a letter from the Consulting Surgeon was sent around to the eye centers. They were not quite the same ones that are functioning now. This letter described the work done in Europe by oculists and by dentists on prostheses. That stimulated us and we started in on it.

At about that time, a patient came from North Africa with a hard spherical mass in the floor of the orbit. We were surprised to find a large acrylic marble, and to note that there was no prosthetic reaction beyond that acrylic marble. It was a very large one, and that was apparently the reason it had dropped out of Tenon's capsule.

We decided if it could stay down on the floor of the orbit for several months and not get any more reaction than that, we would try some spherical implants. We got some marbles and had a dentist run us off some spherical implants. Some were smooth and some were recessed.

During the time I was with Bushnell, we used them with great satisfaction. We had decidedly the impression that it is better to put in a little too small implant than a full or large one.

The work of Col. Cutler has interested me very much. I don't see why those of us in private practice cannot use that type of implant with great success when the material is available.

I have seen Dr. Ruedemann operate. Dr. Ruedemann has an uncanny skill in operating on all these cases. A lot of us are not going to be able to duplicate his work until it becomes more simplified. His eyes do look beautiful and work well.

I have enjoyed the meeting very much so far.

COMMANDER F. M. MORRISON (USNR, Annapolis, Md.): When I came home and practiced with my father, he had tried implants and decided to leave them off. He had given up entirely. To me that was careless. I used bone implants and he used simple enucleation. I don't know whether it involves my operative technique or not, but his results were just as good as mine.

ELEVATION OF ORBITAL CONTENTS WITH PLASTIC PLATES

CAPTAIN B. F. SOUDERS (Dibble General Hospital): Gentlemen: During the past year or more at Dibble, we have encountered a number of traumatic defects of the orbital floor which are quite similar to those which we saw this morning. Many of them were not quite as severe, but some of them were quite comparable.

We found eventually that the usual transplant material such as cartilage or bone, fascia, were inadequate in a number of scores. We were

principally a little wary of cartilage because the transplants were done by the plastic service and they always lived in constant mortal fear that we might do something following the cartilage transplant that would sacrifice that transplant. Also I might add that we used fascia lata with not too encouraging results.

Considering these facts, we entertained a thought of using a plate or wedge of methyl-methacrylate to build up the defects in the floor of the orbit.

We arbitrarily decided on a wedge shaped structure. The first ones were solid, but we very soon decided that perhaps it might be a good idea to place large perforations in the plate in order to allow for the ingrowth of fibrous tissue in order to secure the imbedded plate. The smaller perforations were made even later to accommodate the suture whichwas used to secure the plate in the early post-operative phase.

The plates were made of methyl methacrylate which an ordinary dental technician can do in any dental laboratory. Within the past three weeks, we have considered the use of barium as an impregnating medium in order to make these plates more or less radio-opaque.

We feel that this type of implant offers definite advantages. As I have said, it is very simple to procure. It is easy to insert and can be varied from time to time if the effect is not that which is desired. Alterations can be made. The plate can be impressed further back into the socket if we find it is too far anterior. Additional plates can be added if the correction has not been adequate. The plate can even be removed with ease if indicated. So far we have not had any that we felt it was necessary to remove in the cases we have had.

Considering these advantages, we have used this implant material on 11 cases since September 27, and we feel that the result has been quite gratifying.

The technic of its insertion is simplicity itself. We obtain some idea of the defect of the orbit floor by stereoscopic orbital instruments. We look at them ourselves and determine just how large the defect is. It is a qualitative estimation we admit, but it gives us some notion as to the size of the defects and, therefore, it gives us some idea as to the size of the plates we are going to use.

We usually have a fair number of these plates on the operating table, so that if we did have a miss in our judgment, we could make the necessary adjustment. We have found in some instances we wanted to alter the shape or size of the plate. The plates vary from 15 to 30 millimeters in their depth and width and they are from 3 to 5 millimeters thick. If we find that the plate is too large or the shape isn't just what it ought to be, the dental technician is

consulted and he can vary the shape of the plate in a short period of time. It merely entails a wait of fifteen or twenty minuts while it is being re-shaped and re-sterilized.

We make a curved linear incision in the lower lid, just at the expected position of the infra-orbital margin. That is carried down to the depths of the orbit. In some instances, the infra orbital margin is not there. It is depressed down on the cheek, but we try to make the incision over the point where it should be. By sharp dissection, we create a bed at the floor of the orbit, and the dissection is of such extent that the plate will bridge the bony defect. In other words, this dimension will have covered the bony defect in the socket. We find that it will create a satisfactory infra orbital ridge and it will also elevate the orbital contents quite satisfactorily.

The subcutaneous tissue is closed with interrupted sutures. You may use 4 0 chromic catgut or perhaps 6 0 deknatol. The skin is closed with several interrupted silk sutures. An adhesive compression dressing is placed over the operated eye, and removed in three or four days, at which time the skin sutures may be removed and another compression dressing may be allowed to remain another two or three days.

We haven't seen any noted reaction following the procedure. There has been some necrosis and in one case a small hematoma, but in other ways there has been nothing of note seen postoperatively.

A technique has been described for the reconstruction of traumatic defects of the orbital floor with plates fabricated from methyl-methacrylate. The procedure has been used in eleven (11) cases and appears to be a satisfactory means of (1) elevating the orbital contents, (2) restoring a substantial barrier between antrum and orbit and (3) restoring the contour of the infra-orbital margin.

A number of advantages of the present procedure over bone, cartilage or fascia lata transplantations are apparent. These are its simplicity of technique, ease of subsequent alteration if necessary, and satisfactory tolerance to additional plastic surgical procedures to the eyelids and socket. The presentation is illustrated with lantern slides.

... Showing of cases with lantern slides ...

In giving this presentation today, I want to emphasize that it is a preliminary report. We have done these procedures since September 27, of this year, and in spite of that fact, we feel that the results are encouraging enough to date that the procedure can be done. We feel that it is effective to elevate the orbital contents to create a barrier between the antrum and the orbit as well as to reconstruct the inflow of the infra-orbital margins if the defect is not too great.

LT. COL. CUTLER: I might add that we do not feel that this is the answer to all of our problems of fracture of the floor of the orbit.

Although we are not reporting on it, we started using tantalum plates made up of the mold to reconstruct the orbital rim and in connection with that, using derma to fill in the depressed areas on the side. Our plastic surgeons have always been using that on the face, although they have been using dermal plastic grafts and we have just been using derma.

DISCUSSION

CAPTAIN A. E. SHERMAN (O'Reilly General Hospital): Our dental officer who made the acrylic prosthesis was having some difficulty in fitting cases that came back from overseas having surgical evisceration, and those that had had a simple enucleation but who had a fairly full socket below with a rather marked retraction of the upper part of their socket, with a drawing back of the levator and skin below the brow, causing that unsightly depression and also causing a rather wide open eye with any eye prosthesis that he could make.

About six months ago we got together and made some acrylic wedges shaped a little differently from this, of which I will show a picture on Friday, mainly with the idea of elevating the orbital contents and trying to get rid of the depression below the brow in retraction of the upper lid. We were very satisfied with the results.

When we first did them we used a rather simple approach and went through the conjunctiva in the back portion of the socket and almost down into the lower fornix and put our wedge in place. We used dissection to get down in the floor of the orbit, not under the periorbit, put our wedge in place, closed the deeper tissues with catgut and closed the conjunctiva.

We found occasionally the implants would tend to ride forward and we could feel them right on the lower orbital rim. I remember only about one case where you could actually see a little bulge there that was hardly noticeable.

After that we decided it would be better procedure to put them in the same way plastic surgeons have used cartilage to fill in the floor in fractured floor, so we went in through the skin, through the orbital margin, cut the periorbita on the bone and elevate it. It elevates very easily. We elevated far enough back so we could put in our wedge shaped acrylic. We used the larger portion of the wedge posteriorly, the idea being to try to elevate the orbital contents as much as possible in the posterior portion of the socket.

We have also used the acrylic wedges in similar cases to those of Captain Souders, who had fractures of the floor of the orbit with

depression of the globe. Again we have been very satisfied with those results.

Captain Souders didn't say, but I assume he puts these under the peri-orbits. Possibly he doesn't. I notice he used them also to regain a lost orbital margin. We don't do that.

There is another way in which we differ. At O'Reilly, the plastic service has gone through the tantalum plate stage for defects surrounding the orbit and given it up in favor of cancellus bone from the ilium. We ourselves prefer to use cancellus bone from the ilium to build a lower orbital lateral orbital region and even extending lower. If it gets too far from the orbit, we turn them over to the general plastic surgeon.

Of course, our neurosurgeons continue to use tantalum plates for pulsating above the orbit, which includes the orbital rim. They usually get nice results as far as contour goes, and so on.

CAPTAIN B. F. SOUDERS: In answer to that question, we do not ordinarily make an incision of the peri-orbita. In most cases, we have done this procedure. As I said before, the orbital floor has been pushed out of its own position. I don't believe you gain much by going down to its level and putting your plate beneath the periostic peri orbita.

I also neglected to mention that we secure the plate to the smaller portion that you see in the plate with catgut, usually 2 0 chromic catgut. We take a bit of periosteum, any that is available at the margin where the plate is to be inserted, and we try to get the plate back fairly far because we notice the same tendency that Captain Sherman spoke of for the plate to protrude. We feel if it is placed a little behind the normal position and secured with catgut, in a short time fibrosis will take over and will secure the plate to the position that we desire to have.

LT. COL. E. L. SHIFLETT (Crile General Hospital): I feel that a radiologist talking about reconstructive surgery is like a boy out of school. I look upon this problem from a little different aspect, that maybe you don't emphasize sometimes.

In adopting the physiological functions of the muscles of the eye to the form of the body, you have to consider the fact that you are dealing not only with the physiological function of tissues but you are dealing with a mechanical foreign body and there is a certain amount of mechanics that enter into the work.

I noticed in the illustrations there is always a tendency to build up the floor too little. If you will use a method that we have used here, I think you will find that the average growth of the eye lies much higher in the orbit than you usually believe it does.

These films are easy to obtain. All you have to do is make a lateral with your first three films and you can reconstruct the size of these orbits by using the opposite one as normal. Of course, if he has no globe

in one side, it is very easy to make one on the opposite side.

There is one thing here that maybe you thought about and maybe you didn't. I notice that even though these plates are different shapes, the breadth and the length are more or less proportional in all of them.

Reconstructing the floor of the orbit and the roof of the antrum gives you a pretty good idea that those plates are going to have to be made, some short, some long, some thick, some thin in front and some thin behind, I would think because if you study these orbits closely enough you will find that the floor of the orbit slopes from forward upward and backward to the cone at the posterior margin, and if this is allowed for in the mechanical reconstruction of this orbit, I think you may get your corner of elevation farther back. It would be higher farther back than it would be in front. Those things I think must be considered. I think it is one of the problems in which we can help you, particularly in getting too thin a plate skin.

I believe if you study these carefully and compare with the opposite side, using your measurements, you probably won't have to go back and put in these plates.

Another disadvantage of going back and putting in another plate is that you have left those holes for the fibrous tissue to grow into and you have to destroy that.

I believe that if the radiologist applies himself, he can help you out a great deal in some of these little problems that will influence the results.

LT. COL. CUTLER: I was going to say, Colonel Shiflett, that I think the points that you and Colonel Struble have made about the orbit are very useful to us, and we intend to make use of them. We haven't known just how to go about it before.

CAPTAIN SAKLER: We have done several of these cases in patients who had seeing eyes. There we utilized a little trick, using the Maddox rod with the light. We don't inject the globe at all in the orbit, just superficial injection of novocain, which doesn't affect the extra-orbital muscle, and we get a pretty good idea of the amount of cartilage to put in.

DR. JOHN KEYES: I want to ask Captain Souders whether any symptoms were met showing evidence of dysesthesia of the fifth cranial nerve before or after operation.

CAPTAIN SOUDERS: I expected that question would be asked. Surprisingly enough, there weren't any. Several have had anesthesia, which they had due to their original injury, but we have seen nothing of that kind.

CAPTAIN SHERMAN: When you put them in along the peri-orbita, you are likely to get some disturbance of sensation, but I have seen none that had a loss of sensation. They recover normal sensation.

MAJOR VICTOR H. DEITZ: There is one feature I would like to bring out that was not touched upon yet. That is relative to the opacifying agent used in the acrylic material. I have worked with barium sulphate and incorporated it in the methyl methacrylate, and I have found that it requires as much as 25 to 50 per cent of the loading of the material in order to opacify accurately in shooting the X-ray through the skull. That is, however, on a thickness of .051, about a millimeter and a half. That must be computed for the thicknesses that Captain Souders uses.

I believe, however, when we compare our element 73 tantalum, it assumes a very strategic position in the periodic table. One observer probably back in 1890, in his original experiment in the autodynamic effect of metals, trying to disprove the various theories in metal therapy at that time, worked with spirogyra. His experiments were placing this particular botanical specimen in water and tried to inhibit its growth by the introduction of various metals. He came to the conclusion that probably the metal which is completely unionizable, such as tantalum probably is, would be most ideal.

When we compare the barium sulphate, it admittedly is less ionizable than silicon dioxide glass at a pH of 7.2, which we may expect to find. Granted that this is true, we might expect little ionization to occur from those particles that in processing are found on the exterior of the plastic. These particles, however, are in contact with the various tissues and if slipped under the peri-orbita, they will come in contact with the various tissue enzymes.

There is one feature about the use of barium sulphate. It is all right when given in the methods used in radiographic diagnosis, but the barium sulphate seems to be somewhat anti-histogenic in its action. For that reason, if I should want to opacify acrylic, I would prefer by far to incorporate tantalum dust, and there is another possibility that tantalum dust will in the course of time be given off to the tissues. That must be done by technical process whereby it is reduced with corborundum stones and put through about 120 mesh sieve. If that is done, it will take out the particles of the carborondum usually given to the material. Then again, it may be done by using an iron file, whereby you will have to resort to washing with hydrochloric acid to precipitate the iron, leaving the free tantalum which is unaffected by those particular acids.

The tantalum may also be used in little pieces, perhaps some two or three millimeters in length, cut very expediently from tantalum mesh. It works very well. It bonds well. Although I am not in position to quote my results at this time, I have found that it actually seems to stimulate histogenesis, particularly fibrogenesis. As Dr. Ruedemann has pointed out, it is quite evident that it does so. Now if those particles are on the exterior, there is a possibility that there will be a fibrotic

union that will occur right on the surface of those acrylic wedges when inserted in this.

LT. COL. CUTLER: In regard to the use of tantalum, we have been impressed with some of the neurosurgeons' reconstruction of the orbital rim in connection with skull plates. With that idea in mind, we have started to try this out. I am wondering why the plastic service gave up the use of tantalum around the orbital rim.

CAPTAIN SHERMAN: I think probably it was because the orbital rim itself usually involved the malar area or pretemporal area. I believe too often the final results did not give them the contour over that area that they had hoped for, even though they were careful I believe in the dental department in the reform plate. When they switched to the iliac bone, they found it was so much easier around the operating table and also gave them a good solid filling material and became very firmly united. Otherwise, you have some exposed bone at either end. Also I believe that at times they were a little afraid that the collection of serum or blood clot between the tantalum plate caused trouble, requiring drainage afterward and also the possibility of infection.

One other thing I am reminded of is that apparently the boys were complaining of temperature changes when they would go out in the cold with these things.

LT. COL. CUTLER: We are not prepared to comment on this thing really, because we don't know anything about it, but from what little we have done, which is practically nothing, the change in the contour of the tantalum plate at the operating table is one of the easiest things in the world.

CAPTAIN SHERMAN: It is if you use thin finished tantalum and again you don't have much filling material underneath the tantalum.

LT. COL. CUTLER: We don't fill underneath. We bore holes in the plate. It is not a casting. It is an outside shell and the shape is made up from a mass shaped and reshaped at the table. It looks good in the early stage.

CAPTAIN SHERMAN: Some of them do and some of them don't.

LT. COL. CUTLER: I was interested to know what the trouble was.

CAPTAIN SHERMAN: Do you suture with the bone?

LT. COL. CUTLER: We use wire and screws.

CAPTAIN SHERMAN: That is what I mean.

DR. RUEDEMANN: I think that you are talking about something that is necessary. Don't use tantalum plate at all, but the tantalum mesh. You can mold it two or three times and cut it any way you want and mold it at the table and it will stay the way you put it. The tissue grows through it. Don't use tantalum plate. It acts like almost any other metallic surface; it is smooth and the tissue does not grow through it. With the tantalum mesh, the tissue grows to it, and if you want to take it out, you have to cut the tissue.

CAPTAIN SHERMAN: I think the use of tantalum tissue is a good suggestion. I don't believe anyone out our way has been using it for anything. Have you used it for orbital rims and things like that?

DR. RUEDEMANN: Yes, we have tried taking the tantalum mesh and reconstructing the entire socket. You can fold it over any number of times you wish, and then you must fasten it because it does have a tendency to migrate. We have attached it to the peri-orbita with the tantalum wire. If you reconstruct the orbit with the tantalum mesh, you can attach your acrylic eye to that, or if you use it as an inferior plate of the orbit, go through the anterior as suggested by Captain Souders, and again use it in any number of thicknesses you desire.

LT. COL. CUTLER: It sounds excellent. Do you reform that over a mask or not?

DR. RUEDEMANN: Not at all. You can form it as you go along. It shapes itself very readily. Colonel Shiflett has brought up the point that we have had the same difficulty that Captain Souders has, that we have always been a little bit low on the eye side. We were a little bit too conservative rather than the other way.

THE USE OF FASCIA LATA IN RETRO-TARSAL ATROPHY FOLLOWING ENUCLEATION

MAJOR G. L. WITTER (Dibble General Hospital): I would like to report to you the results of 138 cases in each of which we have transferred a strip of fascia lata from the thigh to correct what is probably better known as orbital atrophy of the lid rather than retro-tarsal. You are all familiar with it.

Captain Sherman just mentioned that this depression is frequently corrected when they elevate the orbital contents, and certainly we have noted that, too.

This is a means of correcting the depression which occurs just beneath the brow in the upper lid, in anophthalmic individuals who otherwise have a normal eye socket.

The fascia lata is easily obtained. We use a fascial stripper. If you use a fascial stripper, be sure to keep well above the knee and you will not meet the cross fibers that are there, and considerable subtissue and fat is adherent.

A strip of fascia approximately 12 centimeters by 1½ centimeters in size is obtained and is placed in warm saline until the brow is ready for its insertion.

These are done usually under local anesthesia. If one chooses to do them under general anesthesia, it is wise to infiltrate beneath the orbicularis oculi and in front of the septum prior to making the incisions.

An incision is made over the rim of the orbit at approximately the external angular process or on the surface beginning in the superior tarsal furrow, and coming out parallel to the external angular ligament, through skin and through the fibers of the orbicularis at that point. Then using Stevens' keratotomy scissors, one begins to tunnel and tunnel in curved fashion keeping just immediately beneath the hair in the brow. I think that is very important, and the previously recorded suggestions in the literature that that be carried deep into the orbit I think ought to be corrected chiefly because if we keep in front of the orbital septum and beneath the orbicularis oculi, the fascia will remain inside without migration and will not interfere with elevation or depression of the lid with function of the levator muscle nor will it disappear into the orbit as it would be very likely to do if we carried it beyond the orbital septum.

The tunneling is carried to a point selected by you or your patient, to match the point where the fold in the upper lid normally is seen to stop on his normal side. That may be opposite the superior orbital notch. However, you select that point by previously having examined the patient to determine where the fold does end nasally on him, on his normal side.

Then by opening the lids with the scissors a stab wound is made through skin muscle into a tunnel that you have made and the scissor points then are brought out.

An aneurysm needle is inserted through in the opposite direction from which you just went. Two sutures are carried through it. The needle is then threaded and it now contains the two sutures. We have one black and the other white so we can keep tab on them more easily. They are strong cotton or silk sutures. This is brought through from the direction in which you just went in making the tunnel, and back out in the original or initial incision.

At this point, the fascia is usually divided into two sections by cutting it in half or by incising it lengthwise. Ordinarily, however, it is cut in half because the usual length between these two points is rarely over two inches and it is approximately four centimeters, to be more exact.

A clamp catches the fascia, which has been thoroughly cleansed of all subfascia tissues, so it glistens as you look at it and it is allowed to hang in this fashion. Then taking the pointed barb part of the knife, it is shredded. We feel it is quite essential to shred fascia. It has been done without being shredded, but it seems to mold better and form a smoother insert if it is done.

This is laid over the white suture, or Suture No. 1. That suture is drawn through the preformed tunnel, and this group of fascia pressed here. Then, if it is necessary and a considerable amount of filling is desired, the second strip of fascia, treated in similar fashion as indicated there, is also drawn through. The amount of fascia which one needs is determined likewise at the time that the operation is done.

It is quite essential at this point that one bevel the fascia so a knob does not exist at the initial or the final extremity of the inserted strip.

Following that, one plain catgut 4-0 suture is used to close muscle, and usually two black silk sutures, 6-0, to close the skin in this position. We then insert the conformer the patient is wearing at the time and apply pressure dressing. This dressing is maintained for a period of two days, at which time the black silk sutures are removed, and very frequently, but not necessarily, a pressure is maintained again for a period of 24 to 48 hours.

We feel that fascia lata is a relatively stable substance to insert in the upper lid to reform its contour and suggest it as one means by which this can be done. The oldest case that we have been able to observe has been in sight now for a year and a half.

Summary of 138 cases in each of which a strip of fascia lata was used to redevelop a normal orbital contour in an eyelid where a disfiguring depression had occurred due to atrophy or sinking of orbital content, secondary to enucleation of the eyeball. Pre-operative and post-operative pictures of 4 cases are shown. That the inserted fascia is well-tolerated, without reaction and is known to persist for one and one-half years is emphasized. The technical procedure is described with diagrammatic illustrations.

The only reference to this procedure is in Spaeth's "Textbook of Ophthalmic Surgery."

... Showing of lantern slides of cases ...

We have had only two individuals of the 138 who have gotten any infection and have thereby lost the fascia or had to have it removed, but we have had two other patients who, for a long period of time following the insertion of the fascia, had a rather pinkish red swelling of the lid

and the skin was rather shiny, suggesting that there was a very low grade type of infection. In each of those, at the suggestion of Colonel Cutler, we merely injected penicillin with a little novocain, and the inflammatory reaction cleared quickly and without any recurrence of infection in those two individuals.

In summary, we present these diagrams and pictures to show what we have done in 138 cases. We feel that fascia is a stable substance, that is readily obtained and is easily molded to reform the depression in the brow.

Regarding the leg, in case it comes up, as did the shin before, I would like to say that when you take fascia lata, you very frequently have a bulging of the lateral femoris group of muscles through the gap that has been caused in the fascia lata itself. That disturbed me very much when we first did it. I kept these boys in bed for a period of two and sometimes three weeks, with tight binders and so forth, to see if it would minimize the appearance of this protruding muscle, and it did not. So now we do not ask them to stay in bed any longer than necessary to allow complete healing of the skin wound, approximately five to seven days. The sutures are removed in five days, and it is not consistently true that any remarkable amount of bulging takes place. The ortho pods and the general surgeons who have used fascia for many reasons and take great quantities of it, assure us there is no weakening of the limb when one removes fascia lata. I have watched this thing and of the patients we have had, not one has complained about his limb.

In anesthetizing fascia lata, it might be wise, to some of you who have not used the procedure, to say that you must go beneath the fascia lata to obtain anesthesia, and a great quantity of anesthesia above the fascia lata is of little value. It should be just enough to obtain skin. Anesthesia of the sensory nerves that perforate from beneath fascia lata is sufficient to obtain all the anesthesia necessary.

DISCUSSION

LT. COL. FOX: In regard to the fascia lata site, we have used this procedure and found it excellent. If you take a long narrow strip of fascia lata, certainly not wider than an inch, and if you let your patient up and about much earlier than usual--we let them up in forty-eight hours--you will find the tendency is to minimize the bulge.

CAPTAIN SAKLER: We use quite a bit of fascia lata. We have been taking it in conjunction with the lower and middle third, rather than taking the upper. In not taking too wide a strip, we try to invert the gap by some subcutaneous sutures, and it works out pretty well for us. We haven't had any trouble in that way at all.

LT. COL. CUTLER: Do you use the stripper?

CAPTAIN SAKLER: We strip upward rather than downward. We come right down the fascia lata by doing so, and don't have to go through subcutaneous tissue and fat.

LT. COL. M. E. RANDOLPH (Valley Forge General Hospital): That is a fine operation. We have used it at Valley Forge with a good deal of success.

I would like to ask you how many of those cases that you have done had secondary implants or had implants.

CAPTAIN SHERMAN: Do you feel that the operation that I use at times, using derma to fill out the back of the socket, also helps take care of this retro-tarsal depression?

MAJOR WITTER: To answer Colonel Randolph's question, I do not recall anyone in particular who had a secondary implant. Some of these boys already had implants, in the shape of spherical implants in Tenon's. None of them had any secondary implants in the eye socket.

In regard to whether or not derma will do the whole job--that is, minimize the depth of the eye socket, in an extremely deep socket, and also fill out the sunken or depressed area in the orbital depression of the lid--it has not been our experience that it does, but we have done very few de-epithelialized skin implants. I think probably the men who have had more experience in doing implants in the floor or the orbit might better discuss that than one trying to minimize the depth of the eye socket.

It is true that when you examine boys on the ward, if you press at the inferior orbital rim, if they have an implant, very frequently you will find that your depressed area in the orbital portion of the lid above disappears. That is the impression that has been given by Captain Sherman and also Captain Souders. Captain Souders mentioned it many times at our hospital.

CAPTAIN SHERMAN: I guess Captain Souders has not tried the use of acrylic forms or wedges on the floor of the orbit. In cases with enophthalmus, with small implant--you haven't tried that?

CAPTAIN SOUDERS: No. It alleviates but does not obliterate that impression.

LT. COL. CUTLER: I did a rough check one time on our enucleation cases. We used to have a ward of about 69 or 70 patients, and the two times I ran a check, it ran about 30 per cent with some evidence of depression of the upper lid. It was present in patients who had ball implants as well as in patients who did not.

We do not have any statistics as to the actual number, but certainly in the cases where we have filled out the orbits by putting in any material, whether it has been to put just back in the orbit or whether it is in the floor of the orbit, the tendency has been to overcome that. In some cases, it has completely overcome that, and in others it has not. In one of these cases where we put some plates in, one fellow whose eye was way down still had that depression of his upper lid, but it was much less noticeable.

The question comes up as to the ordinary enucleations where you do have an implant and where it does occur in civilian practice, whether one would put something in the upper lid or something in the floor of the orbit. I don't know the answer. I would be inclined to put in fascia lata at the present time.

CAPTAIN SHERMAN: My impression, from what I have heard here and from our experience, is that most of the boys from overseas, who have not had implants undergo considerable retraction of their socket over a period of about three months. I have watched some of them. They come in, and you have to give them a furlough. In fact, there was one time when we were told to give them ninety day furloughs, that we couldn't work on them that way, just to make room for other patients. It is surprising how much retraction they would undergo during that second, third and fourth month, you might say, after they were wounded. Most of them did not come to us until at least a month after they were originally hit.

I feel that the way I would handle them is to put in a late implant. Use dermis, if you wish, but I still prefer the crude glass spheres if they have roots in them. If you still have too much depression sinking in below the brow, put in a wedge and implant along the floor under the peri-orbita, where it is firmly anchored there.

We never did make holes in our acrylic. Possibly if we had in the ones that we put in by the conjunctival route, they would have stayed a little better where we wanted them. By putting them under the peri-orbita, I am sure that, except in very extreme cases, we give them a very good looking upper lid--that is, under the brow there.

There have been occasional ones, very bad ones, those I think with fractured floor too, in which we have done all three things. At least I remember one in particular where before we used the acrylic we had already put an acrylic groove sphere in, and we used preserved cartilage along the floor of the orbit and elevated his orbital contents very satisfactorily, at least as much as we could. We put in two pretty good sized pieces of preserved cartilage, and then at a later date, we filled in the upper lid with fascia lata, too. We did all three things and it still doesn't look too good.

MAJOR L. J. CROLL (Fletcher General Hospital): We have seen several of these cases. Essentially they have been cases which had no implant whatsoever. When we did a secondary implant usually we corrected it so we were fairly satisfied with the result and so was thepatient. When we weren't, we asked the plastic department to fill out the upper part of that plastic prosthesis. That, too, would help considerably in this effect.

MAJOR CAVANAUGH: I would like to hear what the other men are using, but I feel if you can use an 18 mm. diameter acrylic implant, you usually get away with the problem by just putting in that size implant. I think if you use a smaller implant, you may have a tendency to need further surgery. I would like to know whether I am using a small ball or a large ball. I will speak to one man and he will say, "Fourteen is enough; that is plenty." Another man will want 16. I have gone to 18 and stayed there, feeling that was the answer to the problem in most cases.

LT. COL. CUTLER: How about the custom of using an 18 mm. sphere? What do you use at Valley Forge?

LT. COL. RANDOLPH: Eighteen millimeter.

LT. COL. CUTLER: What has your experience been on the upper lid?

LT. COL. RANDOLPH: Usually quite satisfactory. In most cases of secondary implants, the use of a large implant has served the purpose quite adequately.

CAPTAIN SAKLER: We use 16 to 18 mm. Sometimes you just can't get the 18 mm. in and we use 16. We try to use as large as possible.

I should say, Colonel Cutler, that your observation is conservative. We had a lot of those cases show retraction of the lids two or three months later. They were in the hospital for other things. There seems to be no particular relation.

LT. COL. CUTLER: The length of time following the enucleation probably has some relation to it. What it is, I don't know. The patients I ran the checks on were not overseas cases. That was the time we were getting E.T.P.S. boys in, when they heard about the plastic eyes. They were all civilian cases. We were not impressed with the fact that simple enucleation had caused these retractions, but it could well have been so because we didn't keep any statistics on it. I don't know how long it takes for this retraction to take place.

Apparently in civilian practice, the men in San Francisco to whom I have talked, all of whom put in implants, but I don't know the size, consider that it is quite a problem. Whether they are using 18 or not, I don't know.

MAJOR CAVANAUGH: It must be that the size of the implant has something to do with it because if you take a youngster and remove the eye at six years of age and don't put an implant in, and you see that person at twenty years of age, the facial bones have not formed on the side of the enucleation and you have a depression in your orbital rims. I think it is very important to get a very large implant in, even though you may feel that it may pop out. Personally, I would take a chance on its popping out, just figuring the development of the facial contour in years to come.

I agree with the Captain that the time element in the formation of this fold might be anywhere from two weeks to three months, but it certainly is very rapid. I think the time element has nothing to do with the correction of it either. I really feel that if you put in a large implant, you have solved the problem in at least ninety per cent of the cases.

DR. JOHN KEYES: Just to confuse the record, I want to state that I distinctly have the impression that large implants are very bad. Why? Because they are difficult to hold. In my experience, more of them extrude than the small ones. Based on bitter experiences of my own and other ophthalmologists, I feel that the small implant is much more preferable to the large one. It seems to me that 12, or 14 mm. is just about right.

MAJOR CAVANAUGH: My answer to that is that we all know that the eye fits into a cone, and when Nature or God, whoever made the eye, put practically 25 mm. in diameter there that is the answer.

DR. KEYES: The socket couldn't stand still.

LT. COL. CUTLER: Pfeiffer, in a recent article, reported his observations of some youngsters that had had implants, and it was his conclusion, as I recall, that putting in an implant did favor the development of the orbit on that side, but there was still some reduced orbital capacity on that side. I think he reported on a case he had observed at least seven years.

THE EVALUATION OF RECENT OPHTHALMIC CONCEPTS AS RELATED TO THE FABRICATION OF PLASTIC ARTIFICIAL EYES AND IMPLANT DEVICES

MAJOR VICTOR H. DEITZ, D.C. (Chief, Plastic Eye Service, Halloran General Hospital): I must admit that it was not until just yesterday that I was apprised of the fact that I had been included in the program. I had hoped that I would not be included.

Some of the work that I have undertaken has been in conjunction with Major DeBow of Hallaron General Hospital, for which he should receive considerable credit, and he has very ably cautioned me not to go unnecessarily awry, as most of us sometimes tend to give vent to a little experimental trend. We have tried to hew to the line.

I cannot sensationalize what I am to present. I prefer to remain basically factual. I must admit that I am speaking as the prosthetist and not the ophthalmic surgeon. I cannot say that I have enucleated an eye. I have only observed it. I am rather new in this field. I have only tried to observe what happens in various cases rather critically and have hoped to remain completely unbiased in so doing.

I remember just a few things from Wilder's Craniometry, and I think possibly I can use some of those principles rather strategically in applying it to the conditions with which we are confronted.

This is a compromise, perhaps somewhat as Colonel Shiflett has mentioned, between the Walters and the Caldwell position, not compensating for the 20 to 23 degrees for the divergence of the orbit anteriorly. It is straight ahead in every respect. If you use that as a standard you can compare from that basis.

I would like to say that this case is one wherein we were confronted with a protruding implant sphere, a glass sphere of exactly 20 mm. in diameter. Ordinarily, on the cases I find that a vertical line projected from the infra orbital foramen would normally bisect the implant sphere if it were in its ideal position. This may appear to be alitle bit high, but then again I concur very much with Colonel Shiflett in respect to the so called infraglobal space, when we are concerned with the normal eye, being about twice that of the supraglobal space, so if this were simply over some 5 mm., or possibly 4 mm.,, it would be in its ideal position from the standpoint of prosthetist.

I was able to adduce considerable information by my original work with injection impressions. That has not worked out wholesale for the routine thesis when prosthesis had to be customized. It causes a ballooning of the tissues and the tissues of the socket with the eyelids held in juxtaposition, in such a way that you shoot into the socket and cause a ballooning out of tissues. It follows a physical law which is actually undesirable in our case. It is comparable to reducing the physics to Pascal's principle, where the pressure is equal to all surfaces within the confines of the void upon which the pressure is being impressed.

In this particular case, we had difficulty because we had to include the diametric factor which is 20 mm. of this glass sphere along with its lateral migration, giving us a very slight clearance against the lateral wall of the orbit.

Ordinarily we bring the temporal flange of the prosthesis around that and set it in this particular sulcus. We had difficulty in this case, and it ultimately required considerable technical ingenuity to circumvent that.

The glass implant sphere is, in my opinion, tried and proved, and probably in the opinion of other men it undergoes some ionization so that it has to be removed. That has been observed. However, there is a possibility that with the plastic prosthesis some problem will present itself in the future. We have a friable implant sphere against which a rather comparatively rigid plastic is placed. From the glass eye manufacturers, there have been some few cases wherein a blow struck upon the glass eye has fractured not only the glass eye but the glass implant sphere as well. If that happens when the blow is struck against the glass eye, perhaps in the future we will find there will be an increase in the incidence of such an unfortunate condition when we have the friab le structure behind a relatively rigid one.

I must say that I concur with the three gentlemen who have stated that the larger the implant sphere that can be used, the better, within biologic limits, obviously.

The 20 millimeter implant sphere posed a considerable technical problem, but nevertheless in those cases wherein I have observed the larger implant spheres, there has rarely been any objectionable degree of formation of the upper lid sulcus.

However, there is no doubt that the 18 might be the critical point. A 16 mm. sphere, if we go into geometry and figure the pi or first power thereof, we know is of a volume of approximately 2.5, but when we take the 18, because of the rapid geometric progression, we have a volume of 3.

I have determined the volume of some 25 to 40 prostheses somewhere in there--made by the Army method, the all plastic, and have found them to be actually an average of 2.75 in volume. For simplicity, let us assume that they are 3.

If we take as our premises the fact that the average eye is about 6.5 cc. in volume, when it is enucleated, we give back to the orbit our 3 cc. We must make up 3 1/2 cc. in the anophthalmic socket. We have actually two voids by which we intend to effectively obturate the one void in the normal case.

It is not to be presupposed that because we have the greater volume of 24.5 eye, roughly speaking (it varies a little bit of course) Tenon's capsule will have the same. It will be a little less when it is brought together. So there is no need to go to the extreme and want all the volume in there.

However, again, if the prosthesis be 3, and the implant sphere be 3, that is 6, but the motility of volume is 6.5. That just makes us a little bit short. Nineteen hits it almost exactly, whereas the 20 mm. sphere, because of extremely rapid geometric progression at that point and at its pi or for the first power, would be as great as 5. Now 5 and 3 would make 8, 1 1/2 over, but perhaps that would compensate in those cases wherein there is some atrophy of the peri-orbital tissues, and particularly, as is supposed, the orbital fat.

It is a matter of concern to all of you I know, and I would prefer from what I have seen to see a larger prosthesis inserted rather than a smaller one.

I have not evaluated this statistically. I have tried to remember all these cases, and it is relatively inexplicable why the anophthalmic socket sometimes shows no orbital sulcus and the unusual degree of motility of the posterior wall. Those are the exception, however.

(Slide) In this case, I attempted, as best I could, to bisect the obicularis latus. It is close enough for our purposes, although I did not have the proper devices. What I wanted to see is just what Colonel Shiflett emphasized, and that was the position. I don't quite get what he meant by his Class 1 and Class 2, however, from whatI have seen, it falls within the line of limbus with the patient looking in distant vision.

Consequently, in this particular case, as in all these artificial eyes without exception, there is some degree of exophthalmus. You can see the infra orbital ridge at this point and what would constitute the anterior pole of the cornea if we quite catch it there at that point.

So it was very interesting that it was emphasized. It is exactly what I have found. I cannot use the reading of the exophthalmometer unless I reduce it to a formula that whatever measurement I get on the normal side I can expect a one quarter loss, and then assume that should be the position of the eye on its anterioposterior plane.

This happens to be a glass sphere, a 16 mm. sphere, and it was difficult to palpate it. It receded somewhat, and in so doing there appears a somewhat hiatus between the implant at the prosthesis and the implant sphere which in actuality, by technical test, is more apparent than real.

This is a plastic eye. In these cases, in order to evaluate the degree of effective obturation, when we resort to the sphere extension with the curl back glass eye makers refer to it as the Blind Dutchman, we find it necessary to bring it back so it imposes some stress upon the superior portion of the implant sphere, not an undue stress, as we do not want to depress it. However, we have to get an eye in the socket, and our meridial plane from the lateral aspect must be in absolute verticality.

Of course, you know the plastic eye is completely radio lucent. What we do in this case, and it is most expeditious, is to take .001 tinfoil, adapt it over the eye, adapt it thoroughly. The increase of the surface .001 of an inch is negligible, but it is adequately opaque, so that when you insert it in the socket you can observe the relationship of the prosthesis to the socket. You can determine, if so desired, the degree of mobility of the prosthesis and actually have roentgenographic evidence of same.

(Slide) Probably this is an evaluation of physiognomy. It doesn't look too bad. It looks fairly normal. There is a tendency for the lid from its lateral aspect to diverge toward the medial canthus progressively, and when it is rather taut, we put in a prosthesis. We might get a little line. It gives an impression of canthal folds, which are obviously unwanted. However, I intentionally showed this at this time as sort of a psychological gesture. Both of these are artificial eyes.

... Showing of slides ...

When you find a flaccidity of the inferior lid, you find that the eye must be light, because there is a gravitation factor, but when there is no adherent lateral palpebral ligament and this tissue is rather mobile, then we get this little sag right at this point. We did everything to overcome that. That is as far as we can go by prosthetic means.

Once it is loose from its restraining ligamentous tissues, then it seems to follow the contour of the orbital rim, and, of course, the orbitae on somewhat of a rhomboidal configuration, down a little bit, and this seems to follow it very well. So from what I can see, once there is a laxity on the part of the tissue you no longer have the support of ligamentous attachment to bone, it will assume that acclivity of the infra-orbital ridge.

There seems to be what I dubbed a monocular phenomenon. I try to have the individual look straight ahead and invariably he turns a little bit. He does it instinctively. This is the way they put their best foot forward. They put their best eye forward in this case. That is somewhat psychological because they want the better eye to show a little more. They put it forward.

Secondarily, in view of the fact that they have lost 45 degrees of their vision, this eye loses 45 on this side of the 180-degree field. It is quite possible that they want to turn just a little bit to broaden that vision and compensate and give a little more to this side. In so doing, we frequently find it is those cases that show a little more sclera from canthus to limbus medially than they do laterally, which we do not find ordinarily in the normal individual. That is just one of the features that we pick up.

The decentration of the eye also seems to determine the degree to which the iris itself is decentered one way or another, although we have no definite date on that.

(Slide) This is arcus senilis. We dealt with the juvenalis type. It is very thin, close to the limbus, incontinium. The arcus presenilis, not incontinium, and then a little wider and smaller pupil, concomitant with aging, and the arcus sinilis broader and somewhat irregular in its outline. We can put pentralie or nevi or anything on the eye. This can not be done on the painted disk. This should lie on the plane of the cornea and it is done just that way. It is a fatty degeneration of that particular structure, so that is where it should lie and it should be assiduously simulated.

(Slide) The use of the split conformer. Orthopraxis in ophthalmology I suppose is not a new thing, but Captain Callahan and also Major Coe out at Northington General Hospital have very extensively undertaken experiments along this line. In view of the fact that I realized he was interested in it, I wanted to emphasize this. We tried a different technic rather than to have the screw device with split conformer that will work in either direction - that is, laterally or medially, or both directions simultaneously, or have a unilateral action or act both in superior and inferior direction, or act simultaneously.

This calls for adequate lateral sulcus as well as medial sulcus, and to increase the groove within the medial superior quadrant of the sulcus.

This is a rather sharp conformer, well rounded off, attached to a loop with holes for the reception of the wire with screw adjustment. Ordinarily the socket would be about 28 mm., 28 to 30, internal dimater. On its horizontal plane this was some 16, in order to get it in. It had to expand about 12 to get it up to the 28. This was placed in conjunction with a stabilizing exterior prosthetic device, and with the various guy wires stabilizing this and with our screw adjustment we were able to stretch it.

I think it can be very adroitly carried out, very carefully in every respect, with a check-up and removed perhaps every other day. In this case, unfortunately, we did get a little stretching laterally, although there had also been a mucous membrane graft laterally and inferiorly. We can't effect a stretching day by day. We can get it in this respect in a unilateral direction. It did necessitate the performance of a tarsorrhaphy. Perhaps in some respects there is much to recommend the tarsorrhaphy. I have seen some lid margins which are just a little bit irregular. That might be one objection. We have tried to overcome that by so doing.

Nevertheless it didn't work out entirely to our satisfaction. We got buckling of the upper lid and the punctum slipped under, and it didn't produce what we wanted in the medial superior quadrant. Nevertheless, such a device has possibilities, and I think if a number of men work along the line that something will be accomplished sometime.

DISCUSSION

LT. COL. CUTLER: The only comment I have is that it is our general reaction about a depressed upper lid that it should be corrected by one of the three methods that have been discussed here this afternoon, and not by putting something on the prosthesis that is really a surgical problem, unless there is some reason that the patient or someone else doesn't want to have it done.

... The meeting adjourned at five twenty-five o'clock ...

THURSDAY MORNING SESSION

LT. COL. M. E. RANDOLPH, Eye Consultant, Surgeon General's Office, Washington, D.C., and Chief of the Department of Ophthalmology, Valley Forge General Hospital, presiding.

LT. COL. M. E. RANDOLPH: I am going to take a very few minutes to tell you briefly what the Army has been doing about the rehabilitation of the blind soldier.

During the last war, we knew we had a number of blinded soldiers, but shortly after Armistice Day, these fellows were all gathered together at a place outside Baltimore, in Evergreen, and no one seemed to have the faintest idea who was going to take the responsibility for them. Was the Army going to be responsible, or the Veterans' Administration, or the Red Cross, or even The American Legion?

The result was that the whole program was pretty much chaos, and from what we have been able to gather, from the results we have seen in the so-called rehabilitated soldier of the last war, the results have been pretty poor.

Nothing particularly was done about the blinded in this war until after things got under way. Around the spring of 1943, the Army suddenly woke up to the fact that in training maneuvers and so forth, a number of soldiers were being blinded by training accidents, land mines, grenades, and so forth. They were sent to two hospitals, Lebanon on the West Coast and Valley Forge on the East Coast. They were simply sent there with perhaps the casual remark, "Well, here they are. Do something with them."

Due to the efforts of the staff at Valley Forge at that time, headed by Lt. Col. James Greear, a number of workers who had had a great deal of training in civilian life and were in the Army as privates were gathered together and sent to Valley Forge to start a program.

Due to the efforts of these enlisted men - one from Detroit and another from the New York Institute for the Blind - they recruited a civilian staff of Braille teachers and typists, occupational therapists and so forth, and the program got under way.

It so happened that the majority, to the ratio at that time of about 10 to 1, were being sent to Valley Forge. The program out on the West Coast did not yet become an actuality, and did not become so until Dibble was activated as a blind center, at which time Colonel Cutler took over out there, and he got a blind rehabilitation staff together, and that, too, has been functioning with a great deal of efficiency.

The situation went on, and these boys were being given a certain amount of blind training, but it was decided by the President's Committe President Roosevelt, the Secretary of War, Secretary of Navy, Secretary of State, and Veterans' Administration - to put out a directive to the effect that all blinded casualties, after going through what necessary medical and surgical treatment was indicated, would be sent to a final blind training center, which at that time had not been located.

It also charged the Army with the social rehabilitation, not to be confused with the vocational rehabilitation, which is the responsibility of the Veterans' Administration.

So the Surgeon General's Office immediately started looking for a likely and satisfactory site which could be the main blind training center. They looked at places throughout Pennsylvania, the East, and in Florida, and for one reason or another, each place was rejected as being impractical.

Finally Avon Old Farms, a boys' school outside of Hartford, was established for the purpose of final social rehabilitation. It was quite a job getting that place started, because the Army had culled what training personnel was available. Nevertheless the Army took over on the first of June, 1944, and the Avon Old Farms School, now called Old Farms Convalescent Hospital Special, was opened, and the first group of patients from Valley Forge came there.

In brief, as to the Army's program for blind rehabilitation, I will give you just a sketch of what happens to a blind soldier as he comes into either Dibble or Valley Forge, and take him on through to Avon Old Farms.

He comes in, and he has assigned to him an orienting instructor, spoken of as an "orienter." This is an enlisted man who has been trained by the Blind Rehabilitation staff to be this boy's guide and counselor. The boys often call these fellows their Seeing Eye Dogs. He is responsible for the main activity of blind training, and that is orientation He teaches the boy how to get around the hospital, the proper method of handling a cane, how to go up and down steps, the various little tricks of the trade which are not the least bit obvious to those of us who are sighted In addition to that, he is responsible for this boy's being taught how to eat and how to shave, how to dress, how to keep his room clean. Those things are terribly important.

Along with that, the trainee, as he is called, is immediately seen quite soon after he arrives in the hospital by a man who has been through the mill, and in the Army it has been a fellow who has been blinded and who has undertaken the Army's blind training program. He actually introduces this boy to blindness, the psychological aspect.

It is an extremely important interview. He tells him what it is like to be blind, what the problems are, and what the difficulties are that he will meet, what he can expect and what he cannot expect.

In addition to that, blind counselors are used to interview these boys, to discuss their personal problems. These counselors are people who are civilians, who have been in blind work for years. They may be blind or sighted.

Coincident with the medical and surgical care, this orientation is going on at all times, until the trainee is able to pass satisfactorily a very rigid examination which includes the ability to go around the hospital, to go to strategic points within the hospital, and in the case of Valley Forge, the ability to pass a very stiff examination going around the streets of Phoenixville.

In addition to that, the trainee receives instruction in Braille and typing. Practically all of these boys resent Braille, because it is a stigma of blindness. We are able to talk many of them into it by telling them that it will give them the ability to use their hands, to use their fingers. Particularly for those who want to continue their education, it is impossible for them to do very much about it unless they have some way of taking notes, and Braille is the only way that can be done.

Typing classes are important in the regime, and most of the boys are very enthusiastic about typing because it gives them a degree of independence.

With that, they have a large reconditioning athletic program. These boys can bowl. They have crews at Valley Forge. They have a crew which regularly gets trimmed by the blind in the Navy Hospital in Philadelphia. They play golf, archery. That seems strange for a boy with bilateral enucleation to go on the course at Valley Forge and regularly shoot in the nine holes in a little over 40. He says if he lifts his head up it doesn't go right.

When a trainee has finished his medical and surgical care, he is transferred to Avon or Old Farms. That is pretty much of a finishing school in one respect, and at the same time a sampling school in another. Here they, of course, have to be re-oriented and the same orienter system is in effect there. Old Farms is a rather difficult place in which to find one's way around, because it is built like the medieval architecture of Cambridge or Oxford, and they have a great many obstacles that they have to know how to handle and so forth.

Here they are exposed to as many vocations as possible. To be specific, there are sixty things which are offered these boys. I will give you just a few. There is a large machine shop where they can take down and put up automobiles and so forth, carpentry; woodworking, bookbinding, salesman ship; radio announcing; stand concessions, which is extremely lucrative vocation.

At this time, we are not training these boys for that but we are exposing them to it. The object is to go to a job and pick out something that you want to do in later life, because we are shooting for one thing, and that is not to have these boys sit on the back porch and rock and spend their pension for the rest of their lives.

The course at Avon is a little over four months, eighteen weeks, after which time they are given the C.D.D. and transferred to the Veterans' Administration. Veterans' representatives are at Avon at all times. They are constantly interviewing these boys and finding out what they would like to do when they are discharged. The cooperation we have from the veterans gets better all the time. These boys, after they scatter throughout the country, are being looked after in a very highly satisfactory manner for the most part.

In general, that covers the Army's blind program.

War Department Memorandum 40 40 is a brief outline of what the administrative details are: that is, sending the blinded casualty as soon as he is able to travel, either to Dibble or to Valley Forge. Those of you who may have any blind in your hospital can get them off your hands by sending them to one of those hospitals, depending upon which is nearer his home.

DISCUSSION

CAPTAIN B. F. SCUDERS: What is the total number of blinded casualties in this war?

LT. COL. RANDOLPH: It is roughly about 1050. That includes the Navy blinded, of which there is a small percentage. Our figures have had to suffer a little bit because before we really had any blind center, about 100 fellows were discharged without taking that training, and we have not been able to pick those fellows up very well to know for certain how many there were, but it is roughly 100.

THE VOSSIOUS RING PHENOMENA

MAJOR TRYGVE GUNDERSON (Eye Consultant, Surgeon General's Office): The Vossius Ring is the eponym for a ring which was first described by Vossius in 1903. He made a more extensive report on the same subject three years later at the International Ophthalmological Congress in Lisbon. It is also called the traumatic annular opacity, and has certain other names which usually signify its location or its cause.

It might be defined as a ring which occurs on the anterior lens capsule, only in young individuals, following trauma.

Vossius' original concept was that an object would hit the eye and actually indent the cornea far enough to push the iris against the lens with enough force to leave iris pigment behind on the lens capsule.

This was accepted for a number of years, until another gentleman raised the following objections: That in order to cause a perfect ring, the object would have to be at all times perpendicular to the corneal also that it did not explain certain instances that happened from perforating wounds in the back of the orbit, injuries vis a tergo, as it were.

As time went on, other characteristics were found. Blood was usually found in the eye. It occurred in perforating wounds and non-perforating wounds. But the general concept of iris pigment was the one which was generally accepted by everyone except a man by the name of Handmann, who believed that blood was the important thing and that this might be the residual of blood on the front of the lens.

The subject aroused my interest about a year and a half ago, during the time of the pushover in Italy. It was shortly after the break through at Anzio, when our hospital was moved up to Rome, about a week after the fall of that city. We were set up on the outskirts, and were receiving a great many casualties from the area between Rome and the Arno River. At one time, we had 2700 freshly wounded in our hospital. Naturally, we had a great many eye injuries.

At that time, I observed four soldiers with Vossius rings in the hospital at the same time. The thing that struck me was that the rings were all the same size, regardless of the fact that these individuals were wounded at different times. Some were blown up by mines at night. Others were struck by shell fragments in the middle of the day. Their pupils were, in other words, either dilated or contracted.

I did not see how it could possibly be from the posterior surface of the iris, if this were true, because, as you know, the blast wave travels at some 12,000 feet per second, and the shell fragments themselves scatter about half that velocity, about 6000 feet a second you might say, and the pupillary reflex is rather slow, in the magnitude of two-tenths to half a second. So if a person saw the flash of an exploding shell at night, the pupil wouldn't possibly have time to contract before the eye would be struck.

As time went on, I saw a total of 19 of these Vossius rings, and in every instance the size was constant. It varied between 2 1/4 and 2-3/4 millimeters. This was a simple measurement, but not particularly accurate probably. I just did it with a transparent millimeter ruler, which I held before the cornea and made the measurement with the /8 sphere of the ophthalmoscope.

There were certain other constant features. It was always well formed. It was never seen in its formative stage. It was always complete when first seen.

I never observed it until about the fourth day after injury, and this is very important. You would believe that if the ring were due to a depression of the iris left on it at the time of the injury, the ring would be seen immediately, but this has never been reported. In fact, I believe the earliest two cases - one reported by Dr. Gipner of Rochester - were reported approximately 12 hours after the injury.

It also, as I have said before, occurs in young individuals, never in senile or preseniles.

In my series, each eye had blood inside it, either in the anterior chamber, vitreous or retina, very commonly in the subhyaloid region and often far forward. It is not a permanent damage. The rings usually disappear in anywhere from two weeks to two months.

... Showing of slides ...

One feature on which I have laid a good deal of emphasis is the fact that the inner margin of the ring is very apt to be serrated and disappear into nothing and the outer margin is apt to be quite sharp The inner margin is not very apt to be sharp. If it were an impression of the iris hitting it, you would expect that the free margin of the iris would leave the clear, sharp outline That the reverse is true I think is fairly strong evidence that the iris has nothing to do with it.

To recapitulate, we have a ring which occurs on the anterior surface of the lens in young individuals, always the same size, that has this feature of being irregular on the inner side and fairly regular on the outer side, always occurring with blood in the eye.

In looking for an explanation for this, it is very interesting. The closest that I can come to it is searching for the anatomy of the lens capsule. Busacca and Melli, an Italian and a Brazilian, did some interesting work on the lens capsules some years ago and pointed out that it has three layers, as you all know It has the true capsule or epithelium, single layer of cells, surrounded by the pericapsular membrane, which extends all the way around the lens; and thirdly, we have a membrane called the zonular lamella, which is after all a prolongation of the zonular fibers at the equator. This lamella, according to Busacca and Melli, does not go completely around the lens but ends somewhere in the region where

the Vossius ring begins.

If this be true, the lens capsule must be thinner in this area. I think that it is very likely that a great deal of the interchange occurred in this zone. Of course, the lens does require a good deal of nutriment and the interchange of fluids here satisfies that requirement.

You may ask why the ring is not in all cases a disc. Occasionally, it is but the disc is not the rule. The absorption of the central area may be due to some other factor.

When I was at Valley Forge with Colonel Randolph we had an individual with sympathetic uveitis in one eye, which he had had for a period of two or three months. At that time, we noticed that he had a definite zone of clearing of the precipitates in exactly the same area in which the Vossius ring phenomenon occurred. The precipitates were scattered all over the entire anterior chamber, over the iris, the anterior surface of the lens, and the entire posterior surface of the cornea, but over the same disc-like area enclosed by the ring we found a definite zone of clearing. This was best seen by the ophthalmoscope. Since that time, I have observed another with Dr. Cogan, and someone told me that he saw a very similar one in a patient with siderosis bulbi.

I believe this is additional evidence that there may be an increased fluid interchange in this central area of the anterior lens capsule.

There are still many things that are not known and that I cannot answer. What effect does trauma have? If this be blood, why doesn't it occur in nontraumatic hyphemia? Trauma always seems necessary.

I might mention one patient of Dr. Zentmayer's who had the least trauma of any. He was operating on a patient in Philadelphia many years ago, for squint. Apparently the needle went a little deeper than usual and injured the root of the iris. He found blood accumulating in the anterior chamber, after which time he rapidly finished the operation and put the patient under a double bandage and returned him to his room. When he opened the eye four days later, the patient had a well-marked Vossius ring. This was confirmed by Dr. Holloway at that time.

I repeat that trauma is always necessary, in some way, but exactly what effect it has is something that I cannot speculate about. It may be that it actually loosens the zonular lamella from the pericapsular membrane, or it may have some secondary effect that we yet do not understand.

CAPTAIN JOHN S. McCAVIC (Valley Forge General Hospital): I would like to ask Major Gunderson if it is not true that force applied to an envelope encasing fluid is equally applied in all parts of the enclosed contents, so that it is not necessarily true that the position will have to be perpendicular.

Second, I would like to ask if he thinks possibly traction on the zonular membrane might be responsible for the production of the Vossius ring, since the ring occurs at that point.

MAJOR GUNDERSON: I do not believe I can answer those questions very accurately. As far as I know, fluid's hypothetic pressure in envelope would be similar in all of its parts, except that in the eye you do have a special mechanism in the valve action of the iris and lens. I suspect if the pressure suddenly rose in the anterior chamber it would take an instant before it became equalized in the posterior chamber.

That brings up a rather interesting point, one that has been disputed in this argument, and that is that the lens has a different specific gravity from the other structures inside the eye, and, therefore, the wave of pressure traveling through would have an unequal hypothetical effect on these membranes. In other words, possibly the lens might have more inertia than the iris and they might be thrown against each other at different velocities.

I think it is a possibility that the sudden contraction might loosen the zonular lamella from the capsule. That is a strong possibility, but that alone would not do it. In that case, there would have to be blood pigments or blood derivatives that would be deposited on this same area for some unknown reason.

LT. COL. CUTLER: I would like to ask whether any experimental work has been done on animals.

MAJOR GUNDERSON: Yes, it has been done by a number of people. Gipner, in Rochester, is the last one that I know of. He did it with bebe shots, which are the most common causative agents in civilian life. He stood off at 10 yards from dogs and shot at their eyes. He was not able to produce any, and he tired of it finally.

That has been the experience of others who have tried it. I think they probably have to go up higher in the animal kingdom in order to do it. I believe it would be much more fruitful if you were to do that with baboons.

... Major L. J. Croll, Fletcher General Hospital, read his paper on "End Results in the Treatment of Retinal Detachments at Crile General Hospital."

The retina as a whole is not involved in retinal detachment, but a

cleavage occurs between the two primitive retinal layers, the pigment epithelium remaining in position attached to Bruch's membrane, while the inner retinal layers become separated from it. The retinal pigment epithelium originates from the outer neurectodermal layer of the embryonic optic cup. The remaining layers of the retina arise from the embryonic inner neurectodermal layer. Thus, in retinal separation, the inner layer becomes displaced from the outer layer, allowing the potential space to become an actual space.

All retinal detachments may be classified as secondary and the cases of Idiopathic detachment are probably caused by inflammatory or degenerative changes. Dr. T. L. Terry, in examining microscopic sections of eyes, classifies separated retina into four general types: (1) Retinal separation with typical hole in retina, arising from trauma, and may be associated with mild uveitis. (2) Retinal separation that arises from exudation under the retina. (3) Retinal separation, with uveal melanomas. (4) Retinal separation with myopia.

The types of injuries causing retinal detachments are: (1) Direct injuries to the eye, including perforating wounds, intra ocular foreign bodies, and contusions. (2) Indirect injuries to the eye, as blows and contusions on the head, and countercoup. Duke Elder states that the choroid is more easily ruptured than the healthy retina, and the normal eye can stand the most severe trauma involving even rupture of the sclera and the loss of vitreous without the occurrence of a detachment. We have seen a great many more tears of the choroid in War Injuries than tears of the retina. Severe inflammatory lesions have been recognized as etiological factors in retinal detachment for a long time. It is only comparatively recently that a mild equatorial, and anterior choroiditis, has been considered as a precipitation factor in retinal detachment. In these cases, the detachment is due either to the formation of exudative subretinal fluid, or to traction by fibrous tissue, or to shrinkage of the globe. In war injuries, we have seen severe vitreous hemorrhages, which produce detachments, as a late sequela, by contracting fibrous bands.

Gonin, J., in his latest papers, obtained an incidence of 87% of holes in retinal detachment, and it was his opinion that retinal holes were almost invariably found in retinal detachments if sufficient time were spent in looking for them. Duke Elder, in summing up the significance of retinal holes, states that the hole itself is not sufficient to cause the detachment. Other factors, such as disease, degeneration and severe trauma, play a part in retinal detachment. The consensus of opinion today is that a retinal hole exists in nearly every case of retinal detachment except those caused by intraocular tumor. Retinal tears or holes may be single or multiple and of varied form and size. The types of retinal holes usually seen in retinal detachment are: (1) Crescentic, horse shoe shaped tears, the convexity is always turned towards the optic nerve and usually occurs in the upper half of globe. (2) Round holes, occurring either singly or in groups,

occurs chiefly in temporal half of the globe, mainly in the supra temporal quadrant. (3) Irregular slits and fine sieve like perforations usually seen near or at the periphery. (4) Dialysis or disinsertion at the ora serrata occurs almost always at the lower part of the globe mainly, in the inferior and inferior temporal quadrants. Subsequent detachment spreads slowly backward and upward with delayed involvement of the macula and visual disturbance. In war injuries, when the patient suffers severe, violent trauma, more than one hole is often found in retinal detachment. In several cases, the retina was lacy, ripply, shriveled, sieve like, with many holes.

The position of a retinal tear may be localized ophthalmoscopically by estimating the number of disc diameters ($1\frac{1}{2}$ mm.) from the tear to the disc or ora. This is a gross approximate method and easily done. Each disc diameter is 1.5 mm. and the ora serrata is considered 8 mm. from the limbus of a globe measuring 24 mm. on its anterio posterior axis. Drawing of the fundus with details, and localizing the retinal hole in relation to retinal blood vessels, is another helpful method. George Stine's method, with tables for retinal localization, is a more accurate method. The patient uses Schweigger perimeter at 19 cm. and looks at own eye in mirror or a finger (propioceptive) if macula damaged, using giart scope to look at tear, and draw away until beyond range of arc, rotate arc until it intercepts ophthalmoscopic beam, and read off arc on perimeter arm, and angle through which it is turned, and consult tables for localization of retinal tear on the globe.

All the cases of retinal detachment were operated by different members of the eye staff at the Eye Center, Crile General Hospital, U.S.A.* The operative procedure consisted of a large conjunctival flap, with good exposure of sclera. Area of detachment was outlined with methylene blue, and the scleral area outlined was treated by using a single point insulated tip electrode, causing micro punctures. In many places, the punctures were enlarged to insure adequate subretinal fluid drainage. Drainage holes stay open longer and the retina is more likely to fall back into position, when a special current (coagulation and cutting) is used, thus partial drainage is established early in the operative procedure and the retina is more easily caught by the adhesive choroiditis. Multiple diathermy punctures give adequate drainage, whereas surface coagulation with two or three diathermy punctures may give inadequate subretinal fluid drainage. In war injuries, where the retina often is shriveled and has multiple holes, the entire affected area should be treated, in an effort to close all the retinal tears and cause adhesions of the retina around the holes.

* The two scleral resections were done by Lt. Col. Gilbert C. Struble, M.C.

SUMMARY OF CASES: (See chart on next page)

NAME AND AGE OF PATIENT	AGE OF DETACH-MENT	PREVIOUS SURGERY	ETIOLOGY	HOLES	VISION BEFORE SURGERY	VISION AFTER SURGERY	VISUAL FIELDS
G.J. 19 yrs	3 mo	none	Infla mmatory	none	20/100 J-5	20/100 J-5	Improved
R.B. 23 yrs	36 mo	none	Degenerative	Dialysis	H M J 0	20/100 J-4	Improved
M.J. 35 yrs.	7 mo.	yes	Trauma	yes	5/200 J-0	10/200 J-0	Improved
B.J 23 yrs.	5 mo.	none	Inflammatory	none	5/200 J-0	5/200 J-0	Improved
H.A. 32 yrs.	2 mo.	yes	Trauma	Dialysis	20/400 J-0	20/400 J-0	Improved
R.Z. 23 yrs.	2 mo.	none	Trauma I.F.B.	Dialysis	L. P.	L. P.	Improved
F.R. 24 yrs.	10 mo.	yes	Blast	none	20/20 J-1	20/20 J-1	Improved
R. H. 21 yrs.	11 mo.	none	Inflammatory	yes	20/80 J-1	20/70-3 J-1	Improved
F.L. 19 yrs	3 mo.	yes	Trauma	yes	L.P.	C. F. in T. field	Improved
C O 26 yrs	5 mo.	none	Trauma	Dialysis	L.P.	10/400	Improved
P.P. 24 yrs	5 mo.	none	Trauma I.F.B	yes	L.P.	L.P.	Improved

NAME AND AGE OF PATIENT	AGE OF DETACHMENT	PREVIOUS SURGERY	ETIOLOGY	HOLES	VISION BEFORE SURGERY	VISION AFTER SURGERY	VISUAL FIELDS
S.R. 29 yrs.	2 mo.	none	Trauma	Dialysis	Poor L.P.	Sclerectomy Clear L.P.	Improved
J.E. 21 yrs.	26 mo.	yes	Trauma I.F.B.	Dialysis	L.P.	Sclerectomy 20/100 J-5	Improved
W.M. 25 yrs.	7 mo.	none	Trauma I.F.B.	yes	10/200 J-0	Enucleated	
E.J. 23 yrs.	6 days	2 I.F.B. removed	Trauma	none	L.P.	Enucleated	

Comment:

Areas of dialysis were present in six cases and peripheral holes in five, and no hole was seen in four cases. Extensive barrage was done over the affected area because of the severity of the injuries. The use of a combination coagulation and cutting current, rather than coagulation current, is preferred in securing delayed healing of micro-punctures, thus resulting in adequate drainage, and reattachment of the retina. In cases of spontaneous reattached retina, in young active patients, recurrent detachment resulted when patient became ambulatory, necessitating surgery. Scleral resection was done on two cases of severe retinal detachment with good results.

Acknowledgement is made to Lt. Col. G. C. Struble, Major H. G. Scheie, Major J. D. Sleight and Capt. Hoyt for allowing me to present these cases and to Sgt. Helen Hellebo who performed the visual field studies and prepared the inclosed field records. I take this opportunity to express my thanks to Lt. Col. G. C. Struble for his advice and assistance in preparing this paper.

DISCUSSION

LT. COL. STRUBLE: At the time the retinal detachment became available to us, about two years ago, I will be frank to say that I was a little skeptical. As a matter of fact, I was afraid to use it, having had no experience with it. So before I began using it, I calibrated on animal eyes, on pigs' eyes, using the power settings recommended by the company that put it out.

I think you will remember that there are three main types in your kit. One is the one-point electrode (insulated). They recommended a power setting of 30.

On the two-point, they recommended a power setting of 34 on the Schoenberg Hook. On the six-point electrode (insulated), they recommended a power setting of 50.

I tried all these different settings and variation on pigs' eyes and then dissected them and found that the power settings recommended were, at least with our voltages, much too high. The retina was simply burned up and the selera was burned up.

After dissecting a good many of these eyes, the conclusion that I reached at that time on the one-point type was about 16, or anywhere between 15 and 20. I think it varies in different places, in different towns, depending upon the line voltage. At Billings 16 worked well. Our experience here has been that 18 is about correct.

We found 22 best for the two-point and 20 for the six point, but we have practically discontinued the two latter types and are using now entirely the one-point electrode.

	POWER SETTINGS RECOMMENDED BY LIEBLE-FLARSHEIM CO.	POWER SETTINGS RECOMMENDED BY EXPERIMENTAL AND CLINICAL WORK
One-point Electrode (Insulated)	30	16 (15-20)
Two-point Electrode (Schoenberg Hook)	34	22
Six-point Electrode (Insulated)	50	20

Personnaly, I am quite satisfied with this instrument. I think there are some things about which we have to be careful. The field should be dry, and we must be very careful in putting the tip of the electrode on the sclera that it is entirely perpendicular as the point goes through. If you go through at an angle, you can get a bad tear and bad burn of the sclera and get a considerable prolapse of the vitreous, if you are not careful.

Just a word about the experience that Major Croll described. On that one case that you saw, we used just the surface coagulation, and we did get a very severe chorcidal effusion. I am quite certain that is what it was. The next day the detachment was very much worse, probably because we did not have enough drainage and we had to go back and operate on him later with multiple punctures. He eventually came out all right except that a portion of his retina involved with this massive choroidal effusion no longer functioned, so that he incurred a severe and permanent loss of his field, although his detachment was eventually cured.

I should like to ask if the other members here have had the experience that we have had, that eyes with siderosis do poorly with any kind of surgery.

We had one case of detachment which Major Croll reported with intra-ocular foreign body and siderosis and the eye did poorly. We expected it to do poorly, as a matter of fact, but it was relatively quiet before we operated, and even though we got it out, it still went to pot after wards. So when we find siderosis in the eye we feel quite discouraged about the whole situation before we even do anything.

LT. COL. RANDOLPH: I can certainly agree with you on that. Those eyes with siderosis do poorly.

You found also, didn't you, Colonel Riwchun, that the power setting in the original leaflet put out by the company were far too high? I think we went ahead and put a notice in the Bulletin to the effect that the power setting should be in the range that you describe, Colonel Struble. But didn't you find it that way?

LT. COL. RIWCHUN (Walter Reed General Hospital): Yes, I agree with Colonel Struble that the power setting is way too high. We cut it down to approximately the figures Colonel Struble had. With that it worked well.

MAJOR DeBOW: I would like to ask what the experience of this group is with the injection of air into the vitreous in detached retinas.

COLONEL STRUBLE: We have not used the procedure at all. I am sorry.

LT. COL. RANDOLPH: I had one case where I injected air in the vitreous. I fished around for a foreign body, which reacted slightly to the magnet. His retina was pretty much all off. I went in with a very fine pair of forceps and I think I would have been there yet trying to grab this thing, but I couldn't get it. I filled him up with air, and strangely enough, the retina has since remained in place, although the foreign body is still present.

In another case where a forceps extraction was used on a piece of copper, just behind the lens, with the resultant loss of considerable fluid vitreous so far (it has been about two months now) the man seems still to be all right.

LT. COL. CUTLER: I have injected air in the vitreous and in the chamber and injected saline, and I haven't had any beneficial effects from it.

At one time, I had the idea that perhaps grafts of epithelium might be used, but I never got around to doing it.

I heard Dr. Pischel give a sort of symposium on detachment of the retina about a month ago in San Francisco, and I was impressed with his good results. I am also impressed with the good results that Major Croll and Colonel Struble have had here.

I didn't bring any statistics on our own results, unfortunately.

There is one aspect of detachment of retina which was mentioned here, and which Dr. Pischel himself went over rather offhandedly, and that is the matter of preoperative tension. I think that the matter of preoperative tension is important. McNamee, in reporting

a large series of cases, also found it had a definite relation to the prognosis.

I think that the postoperative tension also is significant because I believe that you can get a reduction of tension, depending on where your areas are put and how you put them, in that you may produce a partial effect of cyclodiathermy. I know of eyes a number of years ago when we did reduce the tension by doing that in an uncontrolled glaucoma.

I also am inclined to think that the condition of the vitreous has a great deal to do with the detachment, in the first place, and also with prognosis in the second place. That, too, we do not ordinarily study or perhaps pay enough attention to.

It has been demonstrated by a number of people that a shrinkage of the vitreous, with demonstrable adhesive bands, has apparently resulted in tears, and I am inclined to feel that we are treating a symptom when we treat a tear. We all know that when we remove foreign bodies that intrude upon the eye without a treatment rather than the hole made, we do not get detachment.

We have all seen a number of eyes that have foreign bodies in them, in which the eye is quiet and there is no detachment. Apparently, it must have got in from a hole.

In some respects, I am amazed that we can re-attach retinas, since we really do not know a great deal about them, I think, as yet.

At our place, we are always arguing about the pinhole glasses, since the fellows come from different parts of the country, and we appear to get results with or without pinhole glasses.

Another thing that has impressed us is that in certain types of detachment, at the end of approximately 18 days, the retina has not been in place, and a month later it has, and he has not worn pinhole glasses.

I don't know how to explain that. If he had worn pinhole glasses, of course, we could explain it as being due to pinhole glasses, but we are at a loss when he does not wear pinhole glasses.

I believe that the condition of the vitreous and the volume of the vitreous is going to have some relationship to our detachment cases and their treatment.

I hope that as a result of the experience we are getting, we will get information which will enable us to make a better prognosis. It is something that we are very much interested in out in San Francisco. I am hoping that we will be able to decide whether we should get our patients up the next day after detachment of the retina or keep them 18 days, whether we should have them wear pinhole glasses or whether we shouldn't.

Pischel demonstrated, as you probably have seen these flasks, one with gel in it and the other with sol. He has a solution--I have forgotten what it is--which shows how when a tear is present a solution will flow behind the membrane and cause detachment to extend.

To me that doesn't have any significance, because the vitreous is a sol gel, and not a sol or a gel. Why you should use one thing to demonstrate one part of your detachment and another thing to demonstrate another part, I don't know, but I think you have to consider the vitreous as a sol gel.

We know that a certain amount of trauma causes so-called synerisis to take place where the solution tends to separate from the gel and if you have a more fluid vitreous you probably should get an extension of your detachment or perhaps the detachment occurs in the first place.

I believe that in adding air or saline you are further disturbing the sol gel relationship and you cannot expect benefit from that type of procedure.

It all ends up to the fact that I guess I don't know very much about it.

DR. RUEDEMANN: I might add a word in regard to our civilian side of the retinal detachment story, and that is it is no good.

In the first place, when you go from the traumatic side to the idiopathic side, you get a rapid falling off in your end results. On the traumatic side, you get between 70 and 90 per cent good results. On the idiopathic or the infectious side, you drop down to anywhere from 10 to 15 per cent.

I concur with Dr. Cutler that there is something wrong with the vitreous. I go one step further, in that in most of the so-called idiopathic retinal detachments, in which the patient gets a blurred area and then goes on to almost complete detachment, these people have degenerative eyes and the operation for retinal detachment does not cure the degenerating globe.

We have reviewed our cases in regard to these, and I would hate to tell you our end results, because you would immediately find fault with the method we are using, and that has nothing to do with it.

We have used single cautery tip, surface cautery, penetrating with the single needle, and we found that neither one was as good as the single Walker pins put through the eye and getting very good drainage.

As you go down the scale and get away from eyes that have been injured, your results fall off very rapidly.

When we take one group, we get a very good result, but when we include them all, our total results are in the neighborhood of 29 per cent good results. I am not bragging about it. I am just telling the facts. In our results, I think we should talk facts.

We have taken these patients who had a so-called idiopathic or infectious type of retinal detachment and have subjected them to a course of typhoid fever therapy plus deep diathermy for a week or ten days, and then done cauterization of the retina. Then we go back and give them their bed rest. They have not been in progress long enough to give the end results.

I might say that it does not look very promising, and the single Walker pin is still the best from our point of view, unless we operate on some of the traumatic ones early enough. A few of them will get better in spite of surgery. I mean by that, that they will get better if no surgery is done. I do believe that they should be operated upon, and I concur with Colonel Cutler that the hole is not always the important point in the retinal detachment, although if it is found it should be corrected. Thank you.

MAJOR CROLL: I would just ask a question, whether anybody else has had any experience with scleral resection.

LT. COL. RANDOLPH: I assisted in one, as did Captain McGavic, but that is as far as my experience has gone. It sounds like a fascinating procedure and I think we will look for cases on which to do it.

... Captain John S. McGavic, Valley Forge General Hospital, read his paper on "Visual Disturbances Associated with Head Injuries ...

The lesions that were studied involve the chiasm, the optic radiations and the occipital cortex. The anatomy and physiology of the chiasmal fibers require no discussion. The geniculo-calcarine pathway lies in the internal capsule behind the sensory fibers and internal to the auditory fibers. Fibers from the upper retinal quadrants lie dorsally while fibers from the lower retinal quadrants lie ventrally. The macular fibers lie between the latter two bundles. It is understood that the visual cortex occupies the medial surface of the occipital lobes from the occipital pole to the anterior end of the calcarine fissure. Posteriorly the visual area extends a little on to the lateral surface of each occipital lobe. This area is thought to include representation of the fixation area. Opinion is divided as to whether or not there is bilateral cortical representation of the macular areas. The consensus is that each cortical macular center represents half of both maculas, that is the left cortex represents the right half of each fixation area, and vice versa. This must be so as there is division of the fixation area of the field of both eyes when the entire occipital cortex on one side is damaged. The so-called "sparing of the macula" is the

rule in vascular disease but is less frequent with traumatic lesions. Sparing of the entire fixation area is less frequently found when the central field is closely studied. One then finds division of the fixation area rather frequent. There are three reasons for sparing of the fixation area: (1) Escape from injury of this area in the cortex. (2) There are two blood supplies to the occipital cortex, the calcarine artery and the middle cerebral artery. (3) Patients may learn to use eccentric vision, particularly when the fixation area is divided. In vascular accidents only one of the two arteries is usually occluded. Hence, sparing of fixation is the rule. In traumatic cases, both arteries may be damaged, or the entire cortex destroyed.

The cortical representation of the macula is quite large as compared with the area representing the larger peripheral portions of the retina. This is analogous to the large motor and sensory areas in the parietal cortex representing the finger and thumb as compared with the areas representing the trunk and the extremities.

In the area striata, the periphery of the retina is represented near the anterior end of the calcarine fissure. Lesions in this area usually include damage to the optic radiations, and few authentic cases have been recorded where isolated injury to this area was present. The upper portion of each retina is represented on the area above the calcarine fissure, while the lower portion of the retina is represented in the area below the calcarine fissure. When the area below the calcarine fissure is injured, one should see a defect in the upper fields of vision. The explanation for infrequency of such defects is that wounds in this area often result in death because of injury to the cerebellum and large blood vessels.

Traquair states that traumatic lesions of the optic nerve and occipital lobe are frequent while trauma to the chiasm is rare, and that lesions in the genicula pathway are more often vascular than traumatic in origin. Twelve cases are reported.

Case No. 1.

Wounded by shell fragment. Sustained skull fracture in left parieto-occipital region.

The field defect was: Right homonymous hemianopsia, congruous with sparing of the fixation area and sparing of the small portion of the lower portion of the right field adjacent to the midline. Vision was 20/15 O.U.

Interpretation: The site of injury, data obtained at operation, X-ray and field defect indicate a lesion of the left occipital cortex. Sparing of the fixation area is probably due to the dual blood supply by the calcarine artery and the middle cerebral artery.

Case No. 2.

Received compound depressed skull fracture with injury to the brain in the right temporo-parietal area, with retained metallic foreign body in the left occipital lobe of the brain, and complete hemianesthesia with no loss of motor function.

Soldier was unconscious for at least two weeks, when later he found he was totally blind. He could move his left arm and leg although he had no sense of position, and that he had loss of sensation over the left side of his body.

The field defect is: Left homonymous hemianopsia with division of the fixation area. The vision at this time was: O.D. L.P.; O.S. 2/200. There was no direct injury to either eye. The hemorrhages in the vitreous could be explained by sudden increase in intra-cranial pressure and consequent compression of vaginal space of the optic nerves and bleeding from the central veins.

Interpretation: Injury to the right occipital and parietal lobes by penetration of foreign body accounts for the left homonymous hemianopsia and left hemianesthesia and mild left hemiplegia.

Case No. 3.

Received comminuted fracture of both leaves of the occipital bone with extensive stellate fractures of both parietal bones, and multiple metallic foreign bodies at a depth of 5 to 6 cm. in the left parieto-occipital area.

He was blind for 15 days when he was finally found to have light perception. He had bilateral papilledema.

The field defect is: Right homonymous hemianopsia with division of the fixation area. Vision: O.D. 20/70; O.S. 20/100.

Interpretation: The injury to the occipital region with tract of foreign bodies through the occipital and parietal lobes, with the data obtained at operation, X-ray examination, and the field defect indicate damage to the left occipital cortex and deeper tissue of the brain.

Case No. 4.

Comminuted fracture of the left parieto-occipital region with damage to the dura and brain.

The field defect is: Left homonymous hemianopsia with considerable loss of the right lower quadrant of the field of each eye, marked

O.S., and with involvement of both fixation areas. The vision: O.D. 20/200; O.S. 6/200.

Interpretation: The site of injury, date obtained at operation, and by X ray examination, together with the field defects indicate damage to the posterior poles of both occipital lobes, especially to right, and the optic radiations on the left.

Case No. 5.

Compound, comminuted fracture of the occipital bone, more extensive to the right side of the midline.

The field defect is: Left homonymous hemianopsia with involvement of both fixation areas and loss of a large portion of the right lower quadrant of the field. Vision: O.D. C.F. at 3 feet; O.S. C.F. at 4 feet.

Interpretation: The left homonymous hemianopsia is due to damage to the right calcarine area. The damaged area in the left occipital cortex must lie above the calcarine fissure and involve the tip of the posterior pole to produce a lower field defect with loss of fixation area.

Case No. 6.

Wounded by sniper's bullet. Struck in the posterior portions of the parietal bones and superior portion of the occipital bone, chiefly to the left of the midline.

The field defect is: Complete right homonymous hemianopsia with loss of about half of the lower left field of each eye and involvement of both fixation areas. There is also loss of the temporal periphery of the temporal field, O.S. Vision: O.D. Hand movements nasally, O.S. Hand movements temporally.

Interpretation: Location of the defect in the skull plus the field defect indicates damage to the left occipital cortex with lesser damage to the right cortex at the posterior pole and above the level of the calcarine fissure producing the defect in the left lower fields and involvement of the fixation areas.

Case No. 7.

Compound, comminuted fracture of the right parietal region with herniation of brain substance from the wound.

The field defect is: Loss of all but a portion of the right lower fields of vision, with loss of both fixation areas. Vision: O.D. Hand movements at 1 foot; O.S. Hand movements at 1 foot.

Interpretation: Bilateral damage to the occipital lobes, greater on the right side, with damage above the level of the calcarine fissure would explain the field defect.

Case No. 8.

Compound, comminuted, depressed skull fracture in the mid-occipital region just above the lambdoidal suture and several deeply placed metallic foreign bodies. Four were near the midline and one was in the right occipital lobe.

The field defect is: Loss of all field of each eye except for retention of 2 degrees in each fixation area. Vision was nil for a long time after injury. Ten months after injury the vision was: O.D. 20/50 and O.S. 20/20 with correction.

Interpretation: Bilateral homonymous hemianopsia with sparing of both fixation areas indicates a lesion to both occipital lobes with cut destruction of the tip of either occipital lobe where macular vision is represented in the cortex.

Case No. 9.

Compound, depressed fracture of the left leaf of the occipital bone and several foreign bodies in the left frontal lobe.

This caused complete blindness, although both pupils reacted to light. There was bilateral papilledema.

The field defect is: Loss of all field in each eye except for retention of 1 degree in the fixation area. This patient is able to read only one letter at a time.

Interpretation: Damage to both occipital lobes with fortunate sparing of the cortical areas representing the fixation area of the retina. Damage to the anterior portion of the calcarine area accounts for loss of peripheral field.

Case No. 10.

Compound, depressed skull fracture in the mid-occipital region with contusion of the right occipital lobe.

The field defect showed a left homonymous hemianopsia with sparing of the fixation area. Four months later, the field defect was a left homonymous lower quadrant anopsia with the fixation area spared. Vision on the earlier date was: O.D. 20/30; O.S. 20/30. On the latter date vision was: C.D. 20/15; O.S. 20/20.

Interpretation: The left homonymous hemianopsia is explained by damage to the right occipital cortex.

The improvement in the field on second examination four months later can be explained on the basis of subsidence of edema in the area adjacent to the destroyed cortex.

Case No. 11.

Injury to the occipital region. Blindness was immediate following the injury. The patient became unconscious about twenty minutes later. Vision returned three days later.

The field defect is a large absolute homonymous hemianopic scotoma. Vision is: 20/200, eccentric, in each eye.

Interpretation: The findings indicate damage only to the posterior tip of the cortex of each occipital lobe, slightly more extensive on the left side.

Case No. 12.

Sustained a blunt, non-penetrating blow in the left frontal region.

The field defect is: On 8 May 1944, the fields showed a clean-cut bitemporal hemianopsia. On 10 September 1944, the right eye showed loss of the entire temporal field, loss of the fixation area and the outer fifteen degrees of the nasal periphery. The fixation area was involved. The left eye showed loss of the entire temporal field except for a small area bordering the midline above the fixation area which was not involved.

Vision was: O.D. 1/200 (eccentric), O.S. 20/20.

Interpretation: The lesion must lie in the chiasm, involving principally the mid-portion with damage to the crossed fibers and sparing of most of the uncrossed fibers.

CONCLUSIONS:

1. Correlation of visual field defects with definitely known sites and types of head injury, the findings at operation, and X-ray examination of the skull offers the best method of studying the cortical representation of different areas of the retina.

2. Cortical representation of the fixation area (macula) is similar to cortical representation of the peripheral portions of the retina. The fixation area is represented at the posterior tip of the occipital lobes while the peripheral portions of the retina are represented in the cortex at the anterior end of the calcarine fissure. Intermediate points of the retina are represented between these two areas of the area striata.

3. Similarly, the upper half of the retina is represented in the cortex above the level of the calcarine fissure, while the lower half of the retina is represented below the calcarine fissure.

4. Neither the fixation area (macula) nor the peripheral areas of the retinas have duplicate areas of representation.

5. It, therefore, follows that homonymous hemianopsia, vertical hemianopsia, and quadrant anopsia can occur in the peripheral field and that the central fields may also show homonymous scotomas which may be lateral or vertical, central or paracentral, hemianopic or quadrantic in shape. Combinations of homonymous hemianopsia and central scotomas also occur when missiles producing oblique wounds pass through the tip of one occipital lobe and through the occipital lobe or optic radiations on the opposite side as shown by Holmes and Lister.

6. Bilateral homonymous hemianopsia with sparing of the fixation areas (cases 8 and 9) represent the antithesis of bilateral central scotomas with normal peripheral fields. These cases support some of the statements in previously stated conclusions.

7. Bitemporal hemianopsia can occur from damage to the chiasm, although it is rarely a "pure" hemianopsia. The mechanism of this damage to the uncrossed fibers alone is not entirely clear. Although each lobe represents half of each eye, the term bilateral representation of the macula is confusing, as the points of representation are precise, they are not duplicated and there is, therefore, damage to fields of both eyes.

DISCUSSION

CAPTAIN ALSTON CALLAHAN (Northington General Hospital): This does not correlate exactly with the paper, but at Northington we have been running a study of electroencephalography in relation to ophthalmology.

A few years ago there appeared in the Journal of the American Medical Association an article by Mayer, using cases similar to these which have been presented this morning, in studying the electroencephalographic changes from the occipital lobe and testing the preception of

light.

I am sorry to say that in running a series of 130 cases, we found there was no direct connection between the electroencephalographic response and the visual ability. In other words, we found that Mayer's paper, while it is true in many cases, is not an absolute way of differentiating true from false bands, because we had some cases in which a normal alpha wave was present which continued without change whether the eyes were open or closed.

You may be familiar with the method of testing. It is simply to have a patient lying down in the room and have the leads from the occipital lobe and have them turn the light on, and have the patient open his eyes.

We also studied to see if there was any help that could be gained with electroencephalography in differentiating different types of eye lesions, and again we found no difference in it. For instance, we have a normal eye on one side and an eye with marked optic atrophy, but not complete, on the other side. Then we would test each eye alternately. In those cases, we found the same type of E.E.D changes. Our findings were almost entirely of a negative nature, but I think they are important because there is creeping into eye literature the belief that the E.E.D. can be used as a method of telling absolutely whether an eye is blind or not, and our experience shows that it cannot.

CAPTAIN McGAVIC: I am sorry that I forgot to say that this paper was prepared with the assistance of Lt. Col. Bedford.

... The meeting recessed at eleven fifty five o'clock ...

Lt. Col. P. R. McDonald, Executive, Medical Service Branch, Air Surgeon's Office, Professional Division, Washington, D.C., presiding.

TESTING OF NIGHT VISION

LT. COL. P. R. McDONALD: For several years, I have been studying night vision. In the early part of my Army career, I did work at the School of Aviation Medicine at Randolph Field.

The problem that presented itself was one of first determining what variation we might expect to find in any individuals that we had in the Air Corps.

If you remember, the Battle of Britain was fought mostly at night. Early in 1940, General Grant went over to England and saw the work that they had been doing in flight vision and came back to this country and insisted that some program be instigated immediately.

The National Defense Research Council of Scientific Research and Development had a Committee on Vision, and at that time two people, the late Lt. Com. Linn of the Navy and I went to Randolph Field, which was in 1941. The Lieutenant Commander went up to the U. S. Enterprise and we conducted studies on several hundred Navy pilots and Air Corps pilots.

We found that it might be expected in a highly selected group of individuals that the variation was very great. So we felt that we could go ahead with developing a test of night vision. We were not too satisfied with the test the British had at that time.

Of course, the aim of any test of night vision, as far as the military service is concerned, is to try to reduplicate the conditions that might be encountered in the night operation, providing you can reduplicate these conditions.

We wanted to know what was the reproducability and reliability of our tests. Could we expect the same results from time to time? Was there enough spread in the scores that we got so we could classify individuals into good, poor, or very good?

The last problem was one of validity. Does this test mean anything as far as night operation is concerned?

To develop a test for the military services, they went back to the original work of Hecht, who did more in this country than anyone else to develop a satisfactory test of night vision.

The Hecht adaptometer was a small instrument to determine the threshold to a flash of light.

Hecht had laid down these five criteria for any satisfactory test at night:

1. One should know the time and the intensity of the light adaptation.

> The reason one had light adaptation before dark adaptation was that everyone would then start from an equal level, and we know the difference when you come in out of sunny day into a dark room or in a dull day. So everybody was given a bright light to shine in their eye for a certain period of time and had to know how bright it was.

2. Then, as far as the testing flash was concerned, it made some difference as to whether the area of the retina you stimulate is nasally, temporally, or how far away from there. The most sensitive part of the retina is approximately seven or ten degrees on either side of the macula. That is the most sensitive portion to flash the light at threshold levels.

> It might interest you to know that in one of the commercial instruments on the market, for sometime in testing one of the eyes, if the object fell on a blind spot they had neglected to take into consideration that 15 degrees on one side, you had the same fixation point.

3. This criteria is one that has to do with an area of retina to stimulate. In the total area, if one used a two-degree field or one used the 20-degree field, one would naturally get a much lower threshold with the larger field.

4. To a flash of light one had to know how long the flash was exposed. The flash of a fiftieth of a second had to be much brighter than one of a sixth of a second, and also that would be brighter than one exposed for one second.

5. You had to know the color of the testing light.

Having these criteria, we did not think that the Hecht adaptometer research instrument was satisfactory for the purpose of the military service, so we reviewed these criteria and decided which we could eliminate to make the test simple.

One thing you could eliminate would be the light adaptation provided you were assured that everybody got an adequate period of dark adaptation. The dark adaptation can be obtained by having individuals sitting in rooms completely dark half an hour, having them wear red goggles with

transmission only in the deep end of the red in a room of this intensity and then spend the last ten minutes in a dark room. So we did away with the light adaptation, since we were only considering the threshold and not the total rate of that adaptation.

The first one then can be scratched off the test for military services.

The second one, the retinal location, demands that one have a fixation device on the instrument, for pilots are taught to use scanning under loading gauge, and we thought by doing away with the fixation device and reiterating it to the pilot as they take the test, that they should use perifoveal vision and move their eyes one way or the other. They would be simulating the conditions under which they would be flying.

We realized that when we took away the fixation point in the night vision test, some individuals would fail the test because they don't do it correctly as the fovea is essentially a blind spot at night and some would probably look at it in some high threshold and actually the dark adaptation is entirely wrong.

The size of the retinal area stimulated depends to some extent on the size letter one is going to use. The criteria that was insisted upon was any test of night vision as far as the night service is concerned should use form discrimination, not just threshold to passage of light.

We wanted to reduplicate the visual tasks that they were to perform at night. Then the argument came up, of course, as it always does, as to what form we would use. The British had a rotating hexagon in which they used airplane, strata ships, processes, and so on, and forms for various sizes and different figures, but we decided we would use just one simple form and go back to use the letter "C" as one does in measuring visual acuity, or the letter "T."

The basis for the test to some extent depends upon at what level of illumination you want to conduct the tests. One flies at night at levels of illumination. This is equivalent to moonlight at this level of illumination.

... Lt. Col. McDonald used the blackboard in explaining his remarks, and also distributed charts ...

I may better explain this chart. This is intensity of the light in value of microlamberts. This is increasing tensity here. If one uses a four-degree "C" one can see that at a level of illumination just below four. If one uses a three-degree "C" it is just a little above. So actually the size of the letter one is going to use in a test like this depends upon what level of illumination one wants to test the visual acuity.

The Aeromedic Laboratory wanted to test visual acuity to very small letter, one-degree "C", which gives visual acuity of approximately 2/200. They said that simulated the night operations. Others insisted that if

you are interested in studying rod vision, you should test using a larger letter, and consequently a lower level of illumination.

We made measurements on brightness of starlight night and moonlight night to find out just where the test should be conducted. Theoretically, one could conduct the test in which one had letters varying from 1/2 degree to 4 degrees, and one would test visual acuity over the entire range of sky brightness. A test of that nature, however, is very difficult to conduct. It is not hard to construct, but it is very poor correlation.

If one tests rod vision, one gets a real good correlation between one or two tests of the same nature, but when one tests cone vision and rod vision, the interval between cone and rod gives very poor correlation tests, and they are not too reliable.

So it was decided, as far as the Air Corps was concerned and the instruments they would use, they would use a two degree "C" which is well within the rod range. The rod is taken over from about 3 to 5 microlamberts and from 5.5 on one is using essentially a cone vision.

This seems like a very simple little problem but actually bickering went on for a year as to whether one should test at higher levels of illumination or at lower levels of illumination.

The size of the retinal area stimulated depends, of course, upon the size of the letter one uses as a test object. If one uses a two degree "C" on a two degree background, one won't see anything but a little break, so one has to use it on a three or four degree background. That is, one would have a field exposed to the eye with a two degree in the center. If one used the letter "T" instead of the "C", one could get a clew as to the position of it by the darker side of the surface. So you have to have a background on which the letter is exposed, which is about twice the size of the letter.

We then incorporated the information we had into a practical test and in the Air Corps we have used four different tests of night vision. The first one I will describe is known as the A.A.F. Eastman Night Vision Tester. It was developed by the Eastman Kodak Company. The instrument actually looks like a small coffin. In the front surface of the instrument, there is a white piece of opal glass, and on that is the letter "C" at a potential angle of two degrees. That letter can take any one of eight positions.

The instrument is automatically run, the light comes on, and the front surface is exposed for five or seven seconds. The light goes out and the "C" takes up a new position.

The test is conducted at eight different levels of illumination, which I will describe later in the method of scoring, and all the individual does is sit back at a distance of 20 feet. This is in a

completely dark room. In front of him he has a small box, and on the front of that is a handle, in which the notching corresponds to the letter "C". Each time the letter is presented, he turns the notch to the position he thinks it is in. If it is correct, it is automatically recorded on a counter on the back of the instrument. So the test was fairly foolproof. Individuals were told to keep using perifoveal vision, and if they had the correct answer, it automatically scored, and it did away with the individual problem of testing which one always has.

This instrument was very expensive. Although it was very fine, it had a lot of mechanical failures, and after while we had more instruments that weren't working than that were working.

Because of the bulkiness of the instrument, it wasdecided that we should try to make smaller instruments, so Dr. Roland of Wilmer Institute devised a small portable night vision tester and it consisted up here of a radium plaque with the letter "C", and around here, with openings, were various density filters. One rotated the front surface around this increasing density and found out at what density the individual could see the "C". The "C" could be turned by means of a globe at the back into one of four positions. The instrument was held at 13 inches, with a string around the individual's neck, and the test returned to "C", in whatever direction it was taken.

The Aeromedic Research Laboratory developed a night vision tester to some extent on the same principle. They use the letter "C" again at two degrees and vary the intensity, but instead of changing the filters as the individual was tested, they had another system of arriving at the score.

The last instrument we used, and we didn't have very many of them, was a Hecht-Slayer adaptometer, a new model that they developed, which, as a matter of fact, is the best instrument of all for individual testing, and in the hands of somebody who knows how to test, but it was not too satisfactory to knock around the country because it quickly got out of kilter.

The method of scoring on these instruments varied somewhat. On the A.A.F. Eastman Night Vision Tester, the method of scoring was based on the frequency of seeing curve. If you have the light bright enough, you will see all of them. (Illustrating on the blackboard). If you have the light dim enough you will see none of them. So there must be a place in between where you see them all and where you see none, where your threshold lies.

The A.A.F. Night Vision Tester was scored on this principle. There were eight levels of illumination. At the first level, there were five presentations made, at the second level five, and so on. So altogether 43 presentations of the letter "C" were made, and all individuals as a rule saw the first five, and at the last, practically none of the individuals saw them. Sometimes they guessed correctly, but in computing the score allowance was made for guessing.

An individual came up with a score of something over 40. For a while we considered if they got a score of less than 12 they failed the test.

One advantage to a test which is automatically scored and recorded this way is the fact that an enlisted personnel can conduct the test and they don't need too much training. The test is to a large extent semi-automatic but it has disadvantage in the fact that it did break down mechanically.

The other two tests were scored on the basis of seeing three out of four at any one intensity. You gave a person the exposed test object for a period of a second or two, and if you couldn't see the intensity you had, you turned to the next filter and if you saw three out of four, you put that down as the score.

What did we find out with all this elaborate work that was done on night vision test?

We were, as a matter of fact, rather disappointed in our result. We had hoped originally to be able to pick out the good ones and send them to night fighter squadrons and eliminate the poor ones. The test was reliable in the fact that there was considerable spread, and one could pick out some that were very good, and one could pick out some that were very poor, but due to administrative difficulties, it was usually found that the person who was very good was scheduled to go to two-engine school and the night fighters were single engine ships and so on. So that didn't work out too well.

As far as eliminating the people with regard to failing the test, we did that for a while. No air crew were allowed to be air crew if they failed the test. We didn't have much trouble with pilots, bombers and navigators, but nobody wanted to be a gunner. It just took two or three days for them to find out that if they failed the night vision test, they were taken out as gunners, so the percentage of failures in the gunners' school went up to 15 or 20 per cent. We finally had to revise the regulations, and the present status of the night vision test, as far as the A A F is concerned, is that it will be given to all pilots, bombers and navigators at the time of their initial examination. If they fail the test, then they will be given one or two retests with an ophthalmological examination to rule out refractive errors. If high refractive error is found, they will be eliminated as a result of that examination.

As far as any other personnel are concerned in the Air Corps, it is more of a diagnostic aid, and that is what I think it should be.

I think if one had a satisfactory test of night vision - these are fairly satisfactory - one should have it in every hospital and every individual who comes in complaining of difficulty of seeing at night, you would use that as an adjunct, the same as one might use individual field or electrocardiogram or something else.

The Navy have a test with which I am not too familiar. It is a radial plaque which is somewhat similar I think to the Aeromedic Laboratory Test.

I do feel that as far as night vision is concerned in the Army as a whole, one would gain much more from night vision training than one would from night vision testing.

My own feeling is that probably less than one per cent of the people in the Air Corps have pathologically poor night vision. It is true that down at the School of Aviation Medicine, as it was progressed, they saw several cases of people with bad night vision that was due to vitaminosis A. Those cases are fairly rare, and when they are present, you can usually track them down, like the Captain that Captain Scobie told me about, who came from the South and was very fond of his Mother's cooking and was very well nourished and did very well. They sent him to the Aleutians, and after spending several months in the Aleutians, he got very tired of K rations and practically didn't eat them at all. He spent most of his time in the P.X., drinking milkshakes. He came back and was sent to Infantry training, and one time led his whole platoon off the cliff.

The doctor in charge decided they had better examine him for his poor night vision, and they found of the whole platoon, the only two night blind were he and his driver. But those cases are indeed rare.

We have a night vision training program in the Army, in the Air Corps, which unfortunately got snarled up with administrative work and was just getting under way as hostilities ceased. You can take 100 individuals and give them night vision training for a period of one or two hours. You can show them very conclusively that if they will use perifoveal vision, they will do much better at night.

One can take them out and demonstrate to them in the ordinary practice demonstrations.

That is all I have to say about night vision testing. We are not as enthusiastic now about the program as we were three and a half years ago. We have learned a lot about it. I think though that we have a good start for any future developments of any testing devices that may be needed.

... Lt. Col. Phillips Thygeson, A.A.F., Tampa, Florida, read his paper on "The Etiology and Treatment of Blepharitis - a Study in Military Personnel." ...

Blepharitis is a chronic inflammation of the lid border. It can be divided into two general types: (1) the squamous type, characterized by

hyperemia of the lid border with dry or greasy scales, and (2) the ulcerative type, characterized by the development of small pustules involving the follicles of the cilia and leading to the formation of small ulcers. Conjunctivitis and superficial keratitis commonly accompany both types.

Blepharitis is of distinct military importance because the symptoms characteristic of moderate and acute cases, which include burning and smarting, epiphora, photophobia, and asthenopia, interfere definitely with the efficiency of the soldier. These conditions are exaggerated, especially in air crew members, while in high altitude flying. The complications range from internal and external hordeola, meibomitis, and chalazia, to chronic conjunctivitis, marginal corneal ulceration, and, rarely but importantly, trichiasis and entropion.

The determination of etiology is, in most cases, a prerequisite for adequate therapeutic management which in any event requires frequent observation and a judicious rotation of procedures in all but the mildest cases. Blepharitis seems to be definitely increased under tropical conditions.

A survey of the literature reveals that a wide variety of etiologic possibilities have been advanced. The more significant of these are as follows: (1) Bacteria, including staphylococci, streptococci, and diplobacilli; (2) allergy to various substances; (3) fungi; (4) errors of refractions; (5) seborrhea; (6) animal parasites; (7) vitamin deficiencies; (8) endocrine disturbances; and (9) hereditary predisposition. The reports of Burky, Allen, and Thygeson indicated that toxin-producing staphylococci were probably the most important single etiologic feature and that anti-staphylococcic therapy was an improvement over older therapeutic measures. Three hundred fifty cases were available for complete etiological analysis but in a number of cases Army transfers interfered with the completion of therapeutic studies.

Not included in the series were cases of marginal blepharitis seen in connection with such dermatological conditions as exfoliative dermatitis, pityriasis rosea, and herpes simplex. As a minor manifestation of a generalized disorder, the lid margin involvement in these cases differed from typical marginal blepharitis in being self-limited.

I.

Etiology

Comprehensive clinical and laboratory studies were made routinely in the search for features which might have etiologic significance. The clinical survey included examination of the following associated parts: (1) the scalp, for evidences of dandruff; (2) the face, for skin infections such as seborrheic dermatitis, acne rosea, etc., and for evidence of seborrhea; (3) the external ears, for otitis externa;

(4) the tongue, lips, and corneal limbus, for clinical signs of vitamin B complex deficiency; (5) the conjunctiva and cornea, for Bitot's spots and keratinization as evidence of vitamin A deficiency; (6) the cornea, with fluorescein, for evidences of catarrhal infiltration or ulceration and punctate epithelial staining of the type characteristic of staphylococcic infection; (7) the meibomian glands, with expression, to determine the existence of hyperactivity or meibomitis; and finally (8) the lid margins, to determine by means of gross and biomicroscopic observation the clinical type of the blepharitis (whether ciliary or meibomian, ulcerative or non-ulcerative), the type of scales (whether dry, tenacious, or greasy), and the condition of the cilia (whether infected or otherwise abnormal).

In addition to this objective examination, the patient was questioned on the following points: (1) duration of the disease, (2) history or presence of known staphylococcic infections such as styes or boils, (3) dietary habits, with particular reference to vitamin deficiency and to the abnormal use of fats and sweets, and (4) history or presence of pruritus or of other allergic manifestation, such as hay fever, urticaria, or eczema, with particular inquiry into the possibility of drug sensitivity. All cases with abnormal vision or complaining of symptoms of asthenopia were refracted.

Laboratory studies included routine scrapings and cultures of the lid margins, and cultures of the conjunctiva when conjunctivitis was a prominent feature. Conjunctival smears were taken when there was conjunctival secretion or when the history suggested the possibility of allergy. When there was complicating meibomitis, expressed meibomian material was studied for cell content and bacteria. If there was excessive itching, the slides were examined for conjunctival eosinophilia. Other laboratory procedures included the use of special media for fungi and the testing of pathogenic staphylococci for penicillin and sulfonamide sensitivity. Patch tests were used as an aid in the diagnosis of contact dermatitis.

Laboratory Findings:

Table 1.

Laboratory Findings in Blepharitis

(350 Cases)

	No.
Budding yeast forms, only	100
*Pathogenic staphylococci, only	130

*Coagulase-positive staph. aureus and staph. albus

Diplobacilli	4
Mixed yeast forms and pathogenic staphylococci	102
Alpha streptococci	3
Beta streptococci	2
Coliform bacilli	1
Proteus bacilli	2
Normal Flora	6

Etiologic types of blepharitis:

A comparative study of laboratory and clinical findings revealed that only three important etiological types of marginal blepharitis could be distinguished in this series. These were (1) blepharitis due to seborrheic dermatitis, (2) blepharitis due to pathogenic staphylococci, and (3) blepharitis due to the Morax-Axenfeld diplobacillus. Their characteristics are summarized in Table 2. There is a high incidence of mixed seborrheic and staphylococcic blepharitis.

Table 2

Characteristics of the Three Principal Types of Blepharitis

	Staphylococcic Blepharitis	Seborrheic Blepharitis	Morax-Axenfeld (Diplobacillary) Blepharitis
1. Seborrhea capitis	Occasionally present	Always present	Occasionally Present
2. Associated dermatoses	Acne vulgaris, Rosacea, Impetigo, Infectious Eczematoid Dermatitis, Sycosis Barbae, Boils	Seb. derm. of brows & ext. ears frequent	Occasionally dermatitis at external nares
3. Bilateral or unilateral	Unilateral cases not common	Always bilateral	Unilateral cases not uncommon

4.	Ulcerative or non-ulcerative	Frequently ulcerative	Never ulcerative	Never ulcerative
5.	Associated hordeola	Frequent	Rare or absent	Rare or absent
6.	Associated conjunctivitis	Frequent and often severe	Minimal or absent	Always Present
7.	Associated keratitis	Punctate epithelial erosions generally present. Marginal infiltrates and ulcers common	Absent	Marginal infiltrates and ulcers common
8.	Scales and Crusting	Hard tenacious scales removable with difficulty	Greasy Scales, easily removed	Macerated epithelium with minimal scaling
9.	Microscopic examination of lid margin scrapings	Staphylococci and leucocytes	Budding yeast forms (Pityrosporum ovale)	Diplobacilli No leucocytes

Blepharitis of mixed etiology. Mixed seborrheic and staphylococcic blepharitis was the second most common type found in the present series. The diagnosis was made on the simultaneous demonstration of pathogenic staphylococci and large numbers of Pityrosporum ovale in the lesions. Clinically these cases resembled the pure seborrheic form more closely than the pure staphylococcic form except that there were usually conjunctival and corneal complications.

Blepharitis in Association with other Diseases. Blepharitis in acne rosacea is a common finding in civilian practice but surprisingly enough only one case was seen at Drew Field in the course of this study. This case was complicated by a meibomitis. That the ocular manifestations were due in large part at least to infection with pathogenic staphylococci was indicated by the striking relief obtained from antistaphylococci therapy. The importance of pathogenic staphylococci in blepharitis in rosacea has been stressed by Wise who found that none of the lesions of rosacea were influenced by riboflavin.

Pediculosis as a cause of blepharitis was considered in two cases of phthirias palpebrarum discovered at Drew Field, but in one the presence of pubic lice and nits on the lashes did not lead to symptoms of blepharitis, and in the other blepharitis was present but cultures revealed pathogenic staphylococci. That the blepharitis was due to the staphylococci rather than to the pediculosis was indicated by the fact that it persisted after the

pediculi were eliminated.

Blepharitis is not a manifestation of trachoma as the virus does not attack the lid margins. It must, therefore, be considered a complication caused by superimposed staphylococcic or diplobacillary infection.

No single case of true allergic involvement of the lid margins was observed.

Importance of Mild or Sub-clinical Blepharitis.

Routine examination of the lid margins with slit-lamp and corneal microscope in all cases of chronic conjunctivitis revealed a very high incidence of lid margin inflammation which would have been missed if gross examination alone had been relied upon. Biomicroscopically, however, differentiation between normal and pathologic lid margins could be made easily. Differentiation could also usually be made in this way between pure seborrheic and pure staphylococcic blepharitis since the greasy scales of the seborrheic type look quite different microscopically from the dry, fibrinous flakes of the staphylococcic type. Many of these biomicroscopic or subclinical cases of blepharitis could be recognized under examination with the ordinary loupe once attention had been called to them from slit-lamp study.

It is clear that careful slit-lamp examination of the lid margins in chronic conjunctivitis should be made routinely. The conjunctiva could be treated indefinitely without result if the primary focus were in the lid margins and ignored.

Secondary Factors in the Etiology of Blepharitis:

Role of the meibomian glands: It was noted that infection was rare in the absence of hypersecretion and that when it did occur it was in the form of internal hordeola rather than chronic meibomitis. In chronic meibomitis, atonic glands were found which had become coverted into "pus pockets." A number of cases were seen in which isolated infected meibomian glands appeared to constitute foci for the continuance of the staphylococcic blepharitis.

Role of vitamin deficiency. In these series of cases, no clinical manifestations of vitamin A deficiency were noted, nor any signs which could be attributed with any certainty to vitamin B complex deficiency. A number of patients reported excessive intake of fats or sweets or both and some of these were grossly overweight. Both excesses were curtailed in these patients. Such dietary improvement, however, resulted in no observable change in the blepharitis.

Role of refractive error. One hundred ninety cases were refracted. The results are summarized in Table 3.

Table 3.

Refractive Error in Blepharitis

Analysis of 190 Cases

Emmetropia		44
Myopia		22
	Low	3
	Moderate	12
	High	7
Hyperopia		15
	Low	15
	Moderate	0
	High	0
Hyperopic Astigmatism		12
	Low	11
	Moderate	0
	High	1
Myopic Astigmatism		5
	Low	5
	Moderate	0
	High	0
Mixed Astigmatism		13
	Low	12
	Moderate	1
	High	0
Compound Hyperopic Astigmatism		42
	Low	26
	Moderate	12
	High	4
Compound Myopic Astigmatism		36
	Low	15
	Moderate	16
	High	5

* Low Error = less than 1.00 diopter
Moderate Error = 1.00 - 5.00 diopters
High Error = 3.00 + diopters

The patients receiving glasses for correction of refractive errors were carefully questioned as to whether or not they felt that the wearing of the glasses alleviated their symptoms. While a few claimed that their eyes felt more comfortable with the glasses, the general opinion was that the disease had not been noticeably influenced.

Role of personal hygiene. A number of soldiers stated that although the condition had been present from childhood, they never had serious trouble with it until entering military life. The main factor seemed to be the difficulty of maintaining personal cleanliness under field conditions which tended to increase staphylococcic infections of the skin generally.

Role of allergy. Allergies appeared to play no role whatever in the etiology of marginal blepharitis in this series although there were a number of cases of allergic involvement of the entire lid area from drug sensitivity and contact dermatitis due to cosmetics.

Role of heredity. There appears to be a definite hereditary factor in blepharitis. In a significant number of cases in this series, there was a history of familial occurrence, particularly in parents and grandparents. The well-known susceptibility of blond skins to blepharitis was observed; however, the disease being relatively rare among brunette and negro troops.

Role of endocrine glands. The role of endocrine factors could not be determined in this series.

DISCUSSION

In view of the steady advances currently being made in specific therapy of infectious disease, it is increasingly important to determine etiology in ocular disease. Many ocular infections are still of unknown etiology and many are not specific entities. It is evident from this and other studies that blepharitis is by no means an etiological entity but has a varied etiology comparable to that of other infections of mucocutaneous junctions such as perleche. It is also suggested by this study that mixed infections are almost as common in blepharitis as pure infections.

In the absence of direct lid inoculation experiments with staphylocci, their pathogenic role in blepharitis must be assumed on the basis of our knowledge of the staphylococcic dermatoses. It is well known that staphylococci have a special predilection for the skin and attack this tissue in various ways to produce the clinical pictures of impetigo, infectious eczematoid dermatitis, folliculitis, etc. These types of skin reaction were seen in staphylococcic blepharitis of this series. Furthermore, the etiologic relationship of staphylococci to certain types of blepharitis is clearly shown from therapeutic studies in

which elimination of the organisms resulted in rapid healing of the disease and failure to do so resulted in its persistence.

It is very difficult to draw a clear distinction between pathogenic and non pathogenic staphylococci in spite of the numerous studies which have been made on the subject. The criterion used in this series, i.e., the ability of the organism to give a positive coagulase test, is certainly not one hundred per cent reliable. On clinical grounds, it is suspected that certain coagulase negative strains of staphylococcus aureus are pathogenic for the lid margins, but further studies will be required to prove or disprove this suspicion.

In the interests of speculating on the origin of the lid margin infection, an attempt was made to obtain the history of onset in each case. While the data secured was not sufficiently reliable to warrant statistical analysis, certain information of value was obtained. Most patients with staphylococcic blepharitis gave a history of onset in childhood Certain of these recalled definite onset after measles, impetigo, acute conjunctivitis, and hordeola. In the few cases of recent onset, the blepharitis usually followed an attack of styes or of acute conjunctivitis It is well known that pathogenic staphylococci are found very commonly in the nose and particularly in the external nares. It is safe to assume that transfer of organisms from this reservoir to the eyelids by way of fingers or handkerchieves frequently occurs.

The etiologic role of seborrheic dermatitis in blepharitis must be assessed on clinical grounds alone since the etiology of the skin disease itself is still in dispute. The etiologic relationship of the two conditions is clinically apparent, however, from the identity of the lid margin lesions with those of seborrheic dermatitis of the scalp and brow. It seems probable that Pityrosporum ovale will eventually be shown to be the etiologic agent. It was constantly present in the seborrheic belpharitis of this series and its demonstration in large numbers in lid margin scrapings is advanced as a diagnostic sign in spite of the fact that small numbers are occasionally found on the clinically normal lid. In this series, the correlation between laboratory and clinical findings in seborrheic blepharitis was found to be very close.

Diplobacillary blepharitis, which has long been recognized as a disease entity, was surprisingly infrequent in this series considering the fact that it is known to occur commonly in various parts of the country. Diagnosis is not difficult as the organisms are usually numerous in lid margin scrapings and identifiable on morphological grounds alone so that cultural studies are unnecessary. The four cases in this series showed the typical involvement of the angles but a few cases of pure staphylococcic origin also displayed this clinical feature so that diagnosis on strictly clinical grounds is not completely reliable. It is known that diplobacilli also are frequently found in the nose, particularly in the external nares. It is, therefore, likely as has been presumed for staphylococcic blepharitis, that many cases of diplobacillary blepharitis arise as a result of transfer

of infectious material from the nose.

It is of interest that with but few exceptions a cause could be assigned to every case of blepharitis. This, of course, does not mean that determination of etiology was accurate in every case but it does indicate the probability that the common causes of blepharitis are limited to a relatively few agents. Isolated cases, of course, may well be caused by a variety of agents not found in this series. It is believed, however, that this study clearly shows that the ordinary ringworm fungi are not commonly concerned in the disease since ringworm was very prevalent among the patients of this series and the tropical conditions of Florida were conducive to spread of the infection. In spite of this, not a single instance of lid margin infection was noted. It seems probable from this study that streptococci, particularly beta hemolytic streptococci, can occasionally produce or contribute to the production of blepharitis but that they do so very rarely.

Demodex folliculorum, an acarus-like parasite often found in the sebaceous follicles of the face, has been suggested as a possible cause of blepharitis but was not recognized in lid margin scrapings or expressed meibomian secretion from any case in this series.

There seems to be no doubt that increased activity of the sebaceous glands of the lid margins predisposes to blepharitis, particularly the seborrheic variety. However, there were a number of clear-cut examples of staphylococcic infection of the lid margins in individuals with normal skins.

This study has emphasized the importance of routine slit-lamp study of the lid margins in all cases of chronic conjunctivitis. When the mild, subclinical cases thus uncovered are included, blepharitis with its associated chronic conjunctivitis, becomes the most common external infection of the eye.

Summary and Conclusions

1. Blepharitis was the most common external eye infection seen in military personnel at this station. In addition to constituting a cosmetic blemish, it was an important cause of ocular disability, both in itself and as a source of conjunctivitis, keratitis, and other complications causing irritation, blurring of vision due to increased secretion, epiphora, photophobia, and eye strain.

2. Laboratory and clinical studies of a series of 350 cases indicated that only three important types of blepharitis occurred; namely, staphylococcic blepharitis, seborrheic blepharitis, and diplobacillary blepharitis. There were many cases of mixed staphylococcic and seborrheic infection. Other causes were unimportant.

3. The three main etiologic types of blepharitis had distinct clinical characteristics and in their pure forms could be differentiated on clinical grounds alone in all but a few rare cases in which staphylococcic blepharitis simulated diplobacillary blepharitis.

4. Microscopic examination of lid margin scrapings facilitated determination of etiology. The finding of budding yeast forms, believed to be Pityrosporum ovale, was considered a diagnostic sign of seborrheic blepharitis although its etiologic role in seborrheic dermatitis is still unsettled.

5. Routine biomicroscopic examination of the lid margin in chronic conjunctivitis revealed a high incidence of mild or sub clinical blepharitis which was usually staphylococcic. It is suggested that most cases of chronic conjunctivitis have their origin in blepharitis which in many instances will escape notice unless magnification is used.

6. Secondary factors in the etiology of blepharitis were found to be, in order of importance, (1) increased activity of the sebaceous and meibomian glands, (2) poor personal hygiene under field conditions of military life, and (3) tropical climate which predisposes to a high incidence of infectious dermatoses. There was no evidence to indicate that vitamin deficiency, refractive error, or allergy played significant roles.

II

Treatment

In this study, it was proposed to test and compare the commonly applied procedures and to evaluate them in relation to etiology as elucidated in Section I. In addition it was proposed to test the therapeutic efficiency of the new chemotherapeutic agents, particularly sulfathiazole and sulfadiazine, penicillin and tyrothricin. Owing to movements necessarily incident to military personnel, there was a great variation in the time during which treatment could be carried out. There were two hundred and sixteen cases, however, which were studied therapeutically over a sufficient period of time for conclusions to be drawn from the results.

As indicated in Section I, only three important etiologic types of blepharitis were found in this series. These were seborrheic blepharitis, staphylococcic blepharitis, and diplobacillary blepharitis. In addition, there was a large group of cases of mixed staphylococcic and seborrheic infection. The treatment of each of these four groups will be considered separately.

The Lid Margin as a Skin Structure.

Although blepharitis would seem to be fundamentally a dermatologic problem, there are certain characteristics of the skin of the lid margin which set it apart from the skin of other areas of the body and make it a very special therapeutic problem. As is best observed with a slit-lamp and corneal microscope, the lid margin is divided into two zones, an anterior zone containing the cilia, and a posterior zone containing the orifices of Zeiss and Meibomius. The two zones are separated by a fine gray line. The anterior zone containing the cilia is entirely cutaneous and can be compared with other hairy areas of the body such as the brows or scalp, but the posterior zone forms a transitional area between skin and mucous membrane and differs from all similar transitional areas of the body in that it contains the orifices of the meibomian glands. These modified sebaceous glands, which are of unusual length, introduce a unique element into the blepharitis problem because of their tendency to secretory derangement and their susceptibility to infection. Furthermore, the fact that the lashes are the only hairs on the body which, because of the irritating effect of soap on the eyes, do not participate in the ordinary soap cleansing of the face and scalp, further differentiates the lid margins from other comparable structures and has a bearing on the treatment of blepharitis. The proximity of the conjunctiva and cornea, moreover, limits in many respects the type of therapeutic measure which can be employed since many semi-irritant agents well tolerated by the skin are not at all tolerated by the mucous membranes.

Treatment of Seborrheic Blepharitis.

There were 52 cases diagnosed as pure seborrheic blepharitis in this series. As previously described in the section on etiology, their most important characteristics were dull, dirty, generally greasy, non-adherent flakes or crusts on the lid margins, with hyperemia and infiltration of the underlying tissues. The condition was never seen without seborrheic dermatitis of the scalp which appeared in all cases to be the primary focus.

The usual dermatological treatment of seborrheic dermatitis, as described in modern textbooks of dermatology, follows four main lines: (1) Dietetic treatment: Avoidance of alcohol and foods rich in fat such as butter, peanut butter, pork products, salad oils, and fried foods. (2) Endocrine treatment: Small doses of thyroid extract for overweight individuals with low basal metabolic rates. (3) Local treatment of skin lesions: Chief reliance on resorcin, sulfur, salicylic acid, and the mercurials, especially ammoniated mercury. (4) Local treatment of scalp.

An attempt was made to apply these dermatological procedures to the treatment of seborrheic blepharitis. After considerable experimentation, the following routine was worked out: (1) Treatment of scalp infection by biweekly shampoos with tincture of green soap and biweekly applications

of an ointment compounded as follows:

Ammoniated mercury	8.0
Salicylic acid	4.0
Cetyl Alcohol base q.s. ad	100.0

(2) Local treatment of the lid margins: Manual expression of the meibomian glands. Careful removal twice weekly of scales, sebaceous material, and desquamated epithelium by vigorous massage of the lid margins with cotton swabs moistened with boric acid solution or 1% silver nitrate. Application of an ointment, consisting of 1% salicylic acid and 1% yellow oxide of mercury in a petrolatum base, with vigorous massage. If any symptoms of conjunctivitis were present, a collyrium of a 1 5,000 solution of oxycyanide of mercury was prescribed for use two or three times daily. (3) Dietary habits were investigated and an attempt made to correct excesses or other errors.

A few patients complained of slight irritation from the use of salicylic acid-yellow oxide ointment but in general it was well tolerated.

Treatment of the scalp infection seemed to have a very favorable effect on the control of the lid margin disease.

Sulfonamide ointments, penicillin ointment and tyrothricin ointment were used without effect. Vitamin B complex was of no value. An attempt to improve dietary habits were not altogether satisfactory owing to the lack of cooperation on the part of some patients and to the difficulty of adjusting diets under military conditions.

Treatment of Staphylococcic Blepharitis.

The non ulcerative form was characterized by dry, adherent scales on an inflammatory base, and the ulcerative form by pustules involving the superficial hair follicles and leading to the formation of shallow ulcers. Complications of hordeola, meibomitis, conjunctivitis, and keratitis were common. Of these meibomitis was the most persistent and troublesome to deal with.

The therapeutic problem in staphylococcic blepharitis revolves upon the following necessities: (1) To destroy the bacteria in the lesions; (2) to eliminate or treat predisposing causes such as seborrhea; and (3) to eliminate other staphylococcic infections of the skin such as impetigo, folliculitis, or furunculosis which could serve to reinfect the lid margins. The main difficulty lies in the destruction of such staphylococci as have gained entrance to the lid margin glands, particularly the meibomian glands.

The following groups of therapeutic agents were used: Silver nitrate, yellow oxide of mercury, ammoniated mercury, bichloride of mercury, oxycyanide of mercury, iodine, salicylic acid, merthiolate, zinc sulfate, and quinolar. Dyes were used, including gentian violet and brilliant green. Sulfonamide, including sulfathiazole and sulfadiazine. Penicillin

and tyrothricin also used. Vaccine, including staphylococcus toxoid and stock and autogenous vaccines.

Tests with ordinary antiseptic drugs:

A useful procedure, was the use of silver nitrate 1 or 2% strength to the lid margins, and simultaneously in ¼% strength without neutralization to the conjunctiva. The procedure was a silver nitrate application as detailed above twice weekly, combined with twice daily applications of 1% salicylic acid -1% yellow oxide of mercury ointment to the lid margins, preceded by the instillation of 1-5,000 oxycyanide of mercury drops into the conjunctival sac. Tincture of iodine appeared to be very useful, especially in ulcerative cases. It was impossible to use 3½% tincture of iodine in most cases continuously, however, due to lid margin irritation, but weaker dilutions were well tolerated. A 2% solution of alcoholic gentian violet and 5% solution of brillian green alcoholic solution, was found to be valuable in some cases.

Tests with sulfathiazole and sulfadiazine:

These drugs were employed in 5% concentrations and appeared to be much more effective than ordinary antiseptics and the majority of cases showed satisfactory improvement or healing.

Early in the study, it was noted that cases without meibomitis responded much more satisfactorily to local sulfonamide therapy than those with it. In the latter event, it was necessary to institute supplementary therapy consisting of manual expression of the glands combined with staphylococcus toxoid or vaccine or both. Although recent cases were always benefited by this treatment, cases of long standing were frequently not relieved, even by repeated meibomian expressions over long periods of time.

In the use of penicillin, the reason for this failure was shown experimentally in two patients to be due to failure of the drug to penetrate the meibomian glands after it had been applied to the lid margin repeatedly. Nor could penicillin be demonstrated in expressed meibomian secretion from two patients on full therapeutic dosage by the intramuscular route.

Tests with penicillin and tyrothricin.

Penicillin was employed in 87 cases. The routine method of application was in solution form (500 units per cc.) and ointment form (1,000 units per gram in a vaseline or vaseline-lanolin base). The drops were instilled four times daily and the ointment applied night and morning. In certain test cases, the ointment alone was used every hour during the waking hours. Penicillin sensitivity tests were performed on each culture. (Table 4.)

Table 4

Penicillin Sensitivity of 98 Strains of Pathogenic Staphylococci

Strain Sensitivity in Oxford Units per cc.	
Inhibited by:	
0.005 u/cc	1
0.01 u/cc	2
0.02 u/cc	16
0.04 u/cc	23
0.05 u/cc	3
0.08 u/cc	11
0.15 u/cc	5
0.32 u/cc	5
1.0 u/cc	5
5.0 u/cc	1
Not inhibited by:	
5.0 u/cc	25
500.0 u/cc	1

Penicillin proved to be moderately effective in relieving the symptoms of staphylococci blepharitis but the results still left something to be desired. In a few instances, clinical cure without relapse was obtained in as short a time as a week, but in general relapses were frequent and some cases proved completely resistant.

There were four cases in which sensitivity to penicillin developed during therapy. Typical contact dermatitis developed and positive patch tests were obtained.

Tyrothricin was employed in only fourteen cases owing to the necessity of purchasing it privately. The drug was applied in the form of drops (33 mg. per 100 cc) and ointment (50 mg. per 100 gms) exactly as in the case of penicillin. Six cases showed marked improvement but the remainder were unchanged. The drug was not irritating to the conjunctiva or lid margins. This method of treatment deserves further study.

In this series staphylococcic toxoid was administered in 55 cases but in only 27 was the full course given. It was used as a supplementary treatment only, local treatment being continued in every case. The few patients who showed extensive skin reactions to intradermal injections of the toxoid improved more rapidly than those with minimal or negative skin reactions.

Treatment of Diplobacillary Blepharitis.

The four uncomplicated cases of diplobacillary blepharitis in this series healed rapidly after short periods of treatment with sulfathiazole ointment used four times daily. No recurrences were noted.

Treatment of Mixed Seborrheic and Staphylococcic Blepharitis.

This type formed the most difficult therapeutic problem of the series. After considerable experimentation, it was found that the seborrheic factor was best treated first. After the slides became negative for Pityrosporum ovale a course of sulfathiazole or penicillin ointment was prescribed and cases in which meibomitis was present were given staphylococcus toxoid. Under the regime satisfactory clinical improvement was obtained in most cases and clinical cures in a moderate percentage.

The secondary conjunctivitis and keratitis were treated with ¼% silver nitrate combined with a collyrium of 1-5,000 oxycyanide of mercury used two or three times daily. The use of staphylococcus toxoid was particularly valuable in the treatment of the corneal complications, especially the superficial keratitis with punctate epithelial erosions. The conjunctivitis and keratitis were very serious complications.

DISCUSSION

The treatment of blepharitis, other than the diplobacillary type which is no problem, cannot be said to be wholly satisfactory at the present time. Although the majority of cases can be relieved under ideal conditions, there is one inescapable factor which militates against permanent cure; treatment with present methods is at best a long drawn-out affair and even on a military post, where cure is free and the time lost in reporting to the clinic is at government expense, certain patients will not cooperate for the required length of time. Under civilian conditions, failure to complete the course occurs very much more frequently. It is clear that future control of the disease will depend largely upon the development of measures which will be effective in days or weeks rather than months. The recent advances in chemotherapy appear to offer only a partial solution to the problem.

From this study, it is apparent that infection of the Meibomian glands is the greatest single factor which must be overcome. Meibomitis was present in all cases which were resistant to therapy and methods for treating it were obviously inadequate. Repeated expressions of the glands was a useful procedure and in some instances resulted in apparent cures. In general, however, expressions were only palliative. The inability of both general and topical chemotherapy with the sulfonamides and penicillin to affect the condition was also made clear in this series. In the case of penicillin to affect the condition was also made clear in this series. In the case of penicillin, at least, it was shown

experimentally that the drug failed to enter the meibomian secretions in demonstrable amounts after local and intramuscular therapy, and the finding was confirmed clinically by the fact that penicillin-sensitive organisms were cultured from the meibomian secretions during the course of both types of treatment. In this connection, it is of interest to report a case of internal hordeolum which developed in a patient receiving 100,000 units of penicillin daily. The strain of staphylococcus recovered from the hordeolum was fully sensitive to penicillin. Hypersecretion of the meibomian glands, with dilatation of their orifices, appeared to be the main factor in their susceptibility to infection. No satisfactory means of reducing this hypersecretion is at present known. In selected cases in this series reduction of fats in the diet had no noticeable affect upon it.

In view of the minimal clinical symptoms incident to pure seborrheic blepharitis, it is apparent that its principal importance lies in its role of providing a suitable soil for the growth of pathogenic staphylococci. The chief problem is the matter of recurrence. The importance of treating the primary focus, the scalp, which is stressed in all textbooks of dermatology, was amply confirmed in this study, for although it was impossible to say positively that recurrences were due to reinfection, the general impression was gained that reinfection from the scalp was common.

Assuming that Pityrosporum ovale is the cause of the disease, the fungicidal effect of all the agents used in this series, including tincture of iodine, silver nitrate, salicylic acid, ammoniated mercury, yellow oxide of mercury, etc., was evident from the results of lid margin scrapings which were negative for the yeast after treatment. The failure of penicillin or sulfathiazole to influence the condition is in accordance with the known fact that these drugs fail to affect mycotic infections.

The recent dermatological literature has been full of reports which have criticized the use of topical applications of the sulfonamide drugs because of the high incidence of allergic reaction. The danger of sensitization has appeared to outweight the benefits to be obtained from local therapy. The results in this series, however, would seem to indicate that sulfathiazole and sulfadiazine can be used for topical application around the eyes with minimal danger since only four sensitizations occurred in the group of over 300 cases treated; two of the four, moreover, were clearly related to previous oral use of the drug. No sensitivities to sulfadiazine developed in any of the 60 cases in which it was employed. Long continued use of the sulfonamides in blepharitis, however, would seem to be not only unwise but unnecessary for if there is to be any clinical response to the drug it will occur within fifteen days at the longest.

Sensitization to penicillin (or possibly to impurities contained in it) occurred in five cases in a considerably smaller series and in the opinion of the writer was of more significance than the allergic reactions to sulfathiazole. There is no adequate substitute for peni-

cillin at the present time so that sensitization could be a serious matter in the event that general penicillin therapy were later needed. On the other hand, since cross-sensitization among the sulfonamides is not common, sulfathiazole sensitivity does not necessarily preclude all subsequent sulfonamide therapy. For this reason, it is recommended that topical penicillin be reserved for those cases that have failed to respond to other medication and that its administration be limited to not more than ten days.

In this series, the only instances of "overtreatment dermatitis" observed were three cases receiving daily applications of 3½% of iodine. The condition was readily recognized and treatment discontinued. The possibility of the deleterious effect of overtreatment was considered at all times and frequent rest periods as well as rotation of procedures were employed in long drawn-out cases for the purpose of detecting it.

Several cases of severe keratitis in blepharitis appeared to be related to insufficient closure of the lids while sleeping. It was possible to obtain observations on these patients during sleep and to show that they did not have normal lid closure. There were other blepharitic individuals, however, with the same symptom but without keratitis. It seemed probable, therefore, that the keratitis was primarily staphylococcic in origin and aggravated rather than caused by the drying effect of incomplete lid closure.

In this series, patients with well-established blepharitis in general exhibited a genuine desire to be cured and were extraordinarily faithful in reporting to the clinic for treatment. Careful questioning, however, revealed that they were not so faithful in the daily use of their medications. As their conditions improved, they became more and more careless about treating themselves. The relative efficacy of clinic versus home treatment was well illustrated in a series of 15 consecutive cases which were available for daily treatment. Improvement was much more striking than in cases which could be treated only once or twice a week.

Summary and Conclusions

1. A large series of blepharitis cases in military personnel were subjected to therapeutic study with the following five groups of medications: (1) Antiseptic or germicidal drugs, including silver nitrate, zinc sulfate, yellow oxide of mercury, tincture of iodine, salicylic acid, sulfur, resorcin, quinolor, and merthiolate. (2) Dyes, including gentian violet and brilliant green. (3) Sulfonamide drugs, including sulfathiazole and sulfadiazine. (4) Antibiotics, including penicillin and tyrothricin. (5) Vaccines, including staphylococcus toxoid, toxoid combined with vaccine, and stock and autogenous vaccines.

2. Seborrheic blepharitis responded best to the following treatment: (1) Daily mechanical cleansing of the lid margins, (2) frequent expression of the meibomian glands, (3) applications of ¼% silver nitrate solution to the conjunctiva and 1% silver nitrate to the lid margins twice weekly, (4) twice daily applications of an ointment containing 1% yellow oxide of mercury and 1% salicylic acid to the lid margins, and (5) treatment of associated seborrheic dermatitis of the scalp, brows, external ears, etc. Sulfathiazole and penicillin applied in ointment formwere ineffective.

3. Staphylococcic blepharitis responded well to topical treatment with the following preparations, listed in order of efficacy; penicillin, sulfathiazole or sulfadiazine, and mercurials, including ammoniated mercury and a combination of 1% yellow oxide of mercury and 1% salicylic acid. Administration of staphylococcus toxoid proved to be an important supplementary procedure. Other measures of therapeutic value included topical application of tincture of iodine, gentian violet, and brilliant green to the lid margins. Treatment of other staphylococcic infections of the face or scalp was important.

4. In staphylococcic blepharitis, a close correlation between the sensitivity of the staphylococcus strain to penicillin and the clinical response of the disease to topical penicillin therapy was noted.

5. Staphylococcic blepharitis complicated by meibomitis was much more resistant to therapy than uncomplicated blepharitis.

6. The four cases of diplobacillary blepharitis which occurred responded completely and rapidly to topical application of sulfathiazole in ointment form.

7. Mixed seborrheic and staphylococcic blepharitis proved to be more resistant to therapy than either form separately. It was found best to treat the seborrheic factor first and to give particular attention to expression of the meibomian glands. After lid margin scrapings had become negative for Pityrosporum ovale, antistaphylococcic treatment with sulfathiazole or penicillin ointment was employed. Staphylococcus toxoid was a valuable supplementary treatment.

8. Contact dermatitis as a result of allergy to both penicillin and sulfathiazole was observed but did not occur often enough to prejudice their use.

9. In pure seborrheic blepharitis, conjunctivitis was an infrequent complication and was readily controlled by the use of mild antiseptics; there were no corneal complications. In pure and mixed staphylococcic blepharitis conjunctivitis and keratitis were serious complications requiring conjunctival treatment with antistaphylococcic agents. The importance of the lid margin infection as the primary focus was obvious in all cases.

10. While local chemotherapy with the sulfonamides and penicillin constitute a great advance in the treatment of staphylococcic blepharitis, the results of this series indicate that therapy is still not entirely satisfactory, especially in cases complicated by meibomitis.

11. Adequate treatment of blepharitis is of distinct military importance both for the removal of local irritation and for the prevention of serious corneal complications.

I am indebted to Major Alfred M. Glazer, M.C., Chief of the Laboratory Service, for placing all laboratory facilities at my disposal, and to Captain Joseph S. Gots, S.C., bacteriologist, and his technicians for making the culture studies. I wish also to thank Captain Morris Waismen, M.C., Chief of the Dermatology Section, for dermatological consultations, and my associates Major S. R. Irvine, M.C., and Captain Joseph W. Hallett, M.C., for their aid in making the clinical studies.

... Applause ...

LT. COL. P. R. McDONALD: I would like to ask who prepares Vatox?

LT. COL. THYGESON: That is the National Drug Company.

CAPTAIN SOUDERS: I would like to ask what Colonel Thygeson considers the best ointment base.

LT. COL. THYGESON: I am not satisfied that there is any one base that is best. I think ordinary lanolin base is satisfactory. There may be a change on that. The dermatologists do have different opinions as to the values of a base. Where you are using a high concentration of the drug anyway, I don't believe there is much difficulty in liberation in the vaseline of lanolin base, one-third lanolin. I think that is open to some question.

"Dendritic Keratitis," Major J. H. Allen (University Hospital, Iowa City, Iowa):

A series of thirty patients with dentritic keratitis were treated by daily intravenous injections of two grams of sodium iodide. The affected eye was maintained under cycloplegia until the cornea held, but there was no other local treatment or general treatment. The eye was not dressed.

Cases of typical dentritic keratitis of one to seven days duration were selected for this series of treatment. All of these cases were unilateral. Four, however, had two to four dentritic ulcers on the affected cornea.

There had been no previous attacks in twenty-five of the patients, whereas five cases had had one to four previous attacks, and this was verified by the finding of corneal scarring under a slit lamp and corneal biomicroscopic examination.

The age range of these patients was from nineteen to forty, one patient being forty, three in the early thirties, and the remainder under twenty-nine years of age.

The weight range was from 135 to 200 pounds.

The number of injections varied from one to fifteen, or an average of seven injections for the series. The cornea healed two to twenty-two days after the first injection of sodium idodide, or an average of eight days for the entire series.

However, upon analyzing the series in relation to the duration of symptoms, there was an interesting correlation with the treatment. In five patients who reported for treatment within twenty four hours after the development of symptoms, an average of three injections of sodium iodide was made, and the cornea healed on the third day after the first injection.

In eleven patients who reported between two and four days after the development of symptoms, an average of six injections were given, daily injections, and the cornea healed in seven days after the first injection, on the average.

In seven patients who had symptoms for five days before treatment, an average of nine injections were made and the cornea healed on the average nine days after the first injection.

In seven patients who had symptoms for seven days before treatment was instituted, an average of ten injections were made and the cornea healed in slightly more than eleven days on the average

The five patients with recurrent dendritic keratitis responded in accordance with duration of symptoms. There was no significant deviation from the averages.

In the above discussion the cornea was considered healed when it failed to show staining by fluorescein with examination of the cornea by microscope and slit lamp. You will see it was not entirely healed.

Examinations after fluorescein stain were made daily during the treatment amd for one week after the cornea had healed, and then once a week for three months, depending upon the availability of the patients. However, there was only one patient that was followed for less than two months after the treatment.

In no case was there any significant increase in staining of the lesion twenty-four hours after the first injection.

In cases of longer duration, the lesion neither increased nor decreased in size for a day or two or three, after the first injection, and then healing was observed to begin peripherally, the dendrites becoming shorter and shorter until there was only a small dash of staining and that disappeared.

After the cornea failed to take the stain, a slight superficial opacity was observed in the line of the dendrites, but this disappeared, leaving the cornea clear in one to three days. Probably that figure should be taken for complete corneal healing.

The visual acuity at the time of the original examination varied between 20/25 and 20/50, depending largely upon the position of the dendritic ulcer.

In the twenty five patients with initial lesions, vision returned to 20/20 or better following treatment. In the five cases with recurrent dentritic keratitis the vision returned to the pre-treatment level as best we could determine. In other words, the vision was not diminished by this attack as far as we could tell.

Neither recurrences nor dendritic lesions developed in the period of observation, that is, within three months after the treatment had been completed. But one patient wrote about a year later that he had had a recurrence. This particular patient had three previous attacks before we treated him for his fourth attack.

Iodine and its compounds have been used in the treatment of dendritic keratitis for many years and in various methods. Perhaps the most common and best has been that described by Gunderson, which consists of the removal of the corneal epithelium around the dendritic ulcer, followed by the application of strong iodine solution. Some individuals leave the eye open after that treatment. Others use pressure dressings. However, the number of recurrences following this method of treatment led Noy to suggest the use of iodides in the form of drops as supplementary therapy. At about that time, the author was using potassium iodide by mouth. However, we encountered a number of cases of iodism and because of it began to use intravenous sodium iodide.

In the beginning of our experience with this drug, sodium iodide was used to supplement the strong iodine treatment. However, the results seemed to justify a trial series with sodium iodide alone.

Sodium iodide was selected because it is less toxic than potassium iodide and in the dose that we recommend and use, iodism is rare.

However, there are a number of precautions that should be observed in its use. One of the first and more important is that no patient with active or healed tuberculosis should be treated with sodium iodide.

A second precaution is that the needle should be well and accurately placed within the lumen of the vein before the injection is given. Otherwise, a painful phlebitis will develop.

A third precaution is that the drug should be injected slowly. Otherwise, the patient will develop a very severe pain in the region of the parotids. This is temporary and apparently causes no great difficulty, but it is distressing at the moment.

In the series of thirty patients, two complications, probably resulting from the use of the drug, were encountered.

In one patient, a severe pain in both sides of the face developed approximately fifteen minutes after the administration of the drug and persisted for approximately three hours, then gradually subsided. This occurred after the second injection of sodium iodide. Fortunately, the cornea was healed the following day and no further treatment was necessary.

In one other patient a mild acne form of eruption appeared over the chest, arms and legs, after five injections had been made. However, in this case, five additional injections were made with only a slight increase in the eruption. These lesions disappeared three days after the last injection.

This incidence of two complications in thirty patients probably is not a true incidence of complications from sodium iodide inasmuch as in 150 patients, or approximately 150 patients, in which similar doses of sodium iodide were given for other ophthalmic lesions only one patient developed a mild acne form eruption, and that was not sufficiently severe to interrupt the course of treatment.

To summarize, briefly, a series of thirty patients with dendritic keratitis were treated by daily intravenous injections of two grams of sodium iodide until the cornea was healed. Symptoms had been present for one to seven days before treatment was instituted. Neither recurrences nor herpetic lesions developed within three months following treatment. However, because of the small number of cases in this series, no definite conclusions can be drawn, except that the results justify further study. (Applause)

DISCUSSION

Colonel Struble: I would like to ask Major Allen if he has used ether on these corneal ulcers. We have used it, I should say, on over 20 cases. We think that it is far superior to the topical application of iodine. The success in the use of ether I am certain depends on the thorough removal of all the involved epithelium over the lesion and around the lesion.

Our usual procedure is to pour about a third of a medicine glass full of ether, hold it close to the patient's eye, and with a loop, a good light and a fine applicator with tight cotton on the end, thoroughly scrub that area with ether, and to make repeated applications even up to as many as ten or fifteen times, running the ether well into the Bowman's membrane.

The advantage that I see in the use of ether is that the patient has practically no pain at all afterwards. My experience with iodine locally has been that the patient has quite severe pain and almost invariably the ulcers will be completely healed by the following morning. Then it is the usual rule in my experience that they will start breaking down maybe on one edge, and treatment may have to be repeated the following day. Ether has been much more satisfactory in our hands than the local application of iodine. I mentioned it to find out whether anybody else has been using it.

LT. COL. PHILLIPS THYGESON: I was extremely interested in this series of Major Allen's.

First of all, on theoretical grounds, we do not have an example of chemotherapy of any of the typical virus diseases. Dendritic keratitis, of course, is caused by one of the typical viruses. So if sodium iodide is of value in the treatment of dendritic keratitis, that is a distinct advantage in chemotherapy.

I have always been under the impression that the action of iodine in dendritic keratitis was not specific but only the actual destruction of the virus in the superficial epithelium, where we know the virus is localized predominantly in the epithelium and the iodization does cause local destruction of the virus.

I am familiar with the fact that a number of dermatologists have used intravenous sodium iodide in herpes zoster, which is entirely urelated, but so far as I know, this treatment has not been sufficiently satisfactory to make it generally used.

So after hearing Major Allen's series, we collected six cases at Drew Field, and we got some results, but not as startling as Major Allen's series, because in the six cases we had four that improved very much under the treatment but did not become entirely healed and it was necessary later to apply local iodine.

In two cases, we didn't seem to get any effect at all. We had one case of disciformis keratitis, which I believe was on the herpetic basis, although we had no actual proof of it, and the sodium iodide did not seem to affect the course of it.

I think this is an extremely interesting observation of Major Allen's and certainly should lead everyone of us to build up a sufficiently large series so we can make a definite conclusion.

MAJOR TRYGVE GUNDERSON: This is extremely interesting I think and certainly it looks as if Major Allen may have influenced the course of dendritic keratitis. I must say it is hard to know what the power is of dendritic keratitis. It is a strange disease. Sometimes it gets well spontaneously very rapidly.

I have forgotten on these cases what was the average duration before you started sodium iodide.

MAJOR ALLEN: One to seven days.

MAJOR GUNDERSON: That is an average of about four or five days, and you have about eight days on top of that for the average duration?

MAJOR ALLEN: Yes.

MAJOR GUNDERSON: That means a little over two weeks.

I think with the series I studied some years ago I had about 225 cases, and I had a normal group that were untreated. I think it was forty some. I thought that the average duration there was about three weeks. Of course, some went on for a long period and others got well very quickly. Your period does seem shorter than that.

I don't remember which ones we chose for normals but I think we probably took an average group. I don't see why iodine should help, but if it does, that is that. (Laughter). I never thought that iodine per se was the reason it got well. I think, as Colonel Thygeson pointed out, it is obviously the fact that you remove the virus infection, and it doesn't make much difference how you remove it, and you change the course of the disease for the better.

I know that Dr. Wheeler used to take the scalpel and simply scrape off and got very good results.

I certainly know that to take alcohol and rub off all the epithelium gets good results. If you kill it all with iodine you get good results. I think the same thing probably is true with ether, if you rub it hard enough you get the epithelium off where the virus is and you help to cure that. If you give it a strong enough dose and make the epithelium come off the cornea, the patient will get well, but the important thing is that you have to get rid of the epithelium, and no antiseptic that does not kill the epithelium itself will cure the disease. But there may be some secondary effect that potassium iodide has in the tissues that does affect it. I think it is very interesting.

MAJOR ALLEN: I would like to say to Colonel Struble that I have had no experience with ether in treatment.

In regard to Colonel Thygeson's discussion, I realize that these patients were early patients and collected them for that purpose. I have

treated patients with longer duration and with numerous recurrences and considerable scarring of the cornea, but unfortunately the majority of those cases were seen and treated before we settled on this routine and the therapy which mixed; that is where we are using the sodium iodide as supplementary treatment to the strong iodine treatment. So we could draw no conclusions at all on that group.

We expect to continue this study and include longer cases.

I might mention that we have studied a few other types of virus lesions with the use of sodium iodide and expect to report some of those observations later, but sodium iodide seems to be effective.

MAJOR T. CAVANAUGH: To add to what Major Allen just said, in 1940, the skin resident was using intravenous sodium iodine for herpes simplex. We treated some of the old chronic dendritic scarred patients that we just didn't want to scrub any more, with intravenous sodium iodide, and we didn't have very many cases, but we were under the impression that they did quite well.

MAJOR GUNDERSON: I have used sodium iodide drops in the past but haven't been impressed with it.

LT. COL. McDONALD: I have seen patients given sodium iodide to take internally, put it in their eyes by mistake. It cleared up keratitis.

... Captain Richard G. Scobee of St. Louis, Missouri, presented his paper on "Ocular Muscle Balance in Flying Personnel." (This paper was not offered for abstraction. It will be published at a later date).

LT. COL. P. R. McDONALD: Those of you who have read the last Archives know there is an article in there by Dr. Adler on "The Physiology of Muscle." He found the same thing that Scobee found when he measured muscle balance, that there was a shift in the direction of esophoria under anoxia. I didn't read the article completely. I just picked it up before I left, but he came to the same conclusion I believe, that it is one process of convergence, either increase or decrease of impulse.

MAJOR DeVOE: I have never been sure why those standards have been established. Why does five diopters of exophoria disqualify a man from piloting? Is there any work along that line?

CAPTAIN SCOBEE: Of course, the airplane, although developed in this country, was only considered as a toy at first. The British and the Italians and Germans saw a little more in it than a toy and took it over. Very shortly after that we found part of the world engaged in the first World War, and it was to the British and to the French and to the Italians that we had to go for information about our own gadget, and when our Air Corps was first started, it was not if a man was fit enough to fly but was he crazy enough to fly. So there was no selection that went on at first.

By the same token, his examination was written up when we went into the last war and presumably done in a hurry, and has remained unchanged since the last war with very minor exceptions.

The reason for the five diopters of exophoria limit, for example, you cannot pin down in the literature, except for one study, for the comment was a rather vague one, the conclusion being that people with exophoria seemed to have more trouble flying than people with esophoria, and so since ten had been seemingly the logical limit for esophoria, I presume they decided to have that and make the limit for exophoria five. There were no valid studies ever done.

LT. COL. McDONALD: Colonel Matthews, who has been head of the Teaching Department in the School of Aviation Medicine for some considerable time, is going to talk to us now for a few minutes on "The Development of Goggles." We have been interested in numerous problems. I spoke to you about night vision testing. We have also been greatly concerned, of course, in the protection of the individual from becoming light adapted and maintaining their dark adaptation. That has involved design, cockpit illumination, and so on. One of the problems we haven't paid as much attention to as we should, but have done considerable work on, is goggles. Colonel Matthews is familiar with that.

THE DEVELOPMENT OF GOGGLES

LT. COL. JOHN L. MATTHEWS (AAF, Randolph Field, Texas): Gentlemen: I will not bore you with a detailed account of the evolution of our various goggles and sunglasses in the Air Forces. Much of the evolution you are perhaps already familiar with.

You will recall that at the onset of this or the recent conflict, our airmen, our fliers, universally were wearing a goggle which consisted of two cylindrical lenses held in a metal frame and seated in a rubber cushion, joined at the nasal bridge by a metallic bridge of varying bridge width.

This is a goggle which had been evolved over a period of years and at the time represented the best available. Yet that same goggle was for several reasons very undesirable, particularly was it undesirable in its limitation of the visual fields.

If we consider the monocular fields of vision and realize that each extends temporally 90 degrees or more and nasally 55 or 60 degrees (illustrating on the blackboard) with an overlapping of 110 to 120 degrees, we will find that the binocular field of vision then measures more than 110 degrees in the horizontal and it will measure in the vertical the sum, we will say, of 70 and 50, about 120 in the vertical.

This then represents the field of binocular vision, that area of our visual field in which our eyes are operating jointly.

Now then, if we place before the eye any type of goggle which will limit our field temporally or nasally, superiorly or inferiorly, we will find a marked reduction in the monocular field, but far more importantly, we will find a reduction in the binocular field of vision. That certainly was the case with the B-7 goggle with which we entered the war. It was found the nasal field measured 23 degrees, which then reduced our binocular field of vision to one which had a transverse diameter of only 46 - well, we will say 50 degrees. Vertically the limitation was not so great. However, this horizontal limitation to 50 degrees was a rather serious handicap to an individual learning to fly. Those who had flown for considerable periods of time had become adjusted to it. It was not so serious to them, but unfortunately it was to the beginner, flying in the open cockpit. He put on his goggles when he first started to fly and then continued with them throughout the period of his service with the Air Corps.

In order to avoid this very serious defect and certain other ones in the B-7 goggle, it became apparent that a single-lens goggle would be desirable.

You recall that early in the war, the Polaroid Corporation produced what it termed an all-purpose goggle, subsequently adopted as standard in the armored forces. It was a sponge rubber base with a plastic shield, a plastic single lens. That was a very desirable goggle, but in the Air Force we had to consider a number of other factors that were not of concern to the ground forces, particularly the integration of the goggle with the helmet, the oxygen mask, and all the gadgets that a modern flier has to hang around him. There was evolved then at the Aero Medical Laboratory in conjunction with manufacturers, a goggle which I believe most of you are familiar with. We term it the B-H Goggle, similar to that early Polaroid all-purpose, it consists of a sponge rubber base with vents above and below for ventilation, lined with chamois to minimize the danger of rubber burns to the face, a single lens, a flexible lens, covering both eyes, a lens made of a metal acetate rather than nitrate, again a fire-prevention measure.

With this goggle, we find that the visual field is limited, the binocular field is limited only some ten degrees, so we have then approached a very desirable solution in the goggle. Perhaps in the future that field will be even further broadened.

One little refinement in that goggle is an adaptation for high altitude flights. Of course, in the 29 it is not so important, it is a heated plane, but in our 17's operating at altitudes that are very high, extreme cold was encountered. Any type of goggle lens in those cold atmospheres was apt to fog or to frost. To circumvent that difficulty, fine wires, spaced at intervals of about 3/16 of an inch, were imbedded in this acetate lens. They were hooked into the electrical system of the plane. The lens was kept warm throughout the flight and fogging was eliminated.

So much for goggles. They have no particular application to our civilian ophthalmologic practice, but I would like to say a little bit about sunglasses. You recall that some fifteen or twenty years ago the popular sunglass was an amber lens. Amber with a very high transmission in the yellow was a very disagreeable lens. Psychologically it was not a desirable filter at all. That was replaced in time by the recently popular blue green or yellowish green lenses, the most popular of which are the A.O. Calabar and the Bausch and Lomb Antiglare or Rayband.

We have been subjected to considerable advertising propaganda on green lenses. Usually the statement is made that they are cooling, that they transmit light or that they will interfere very little with our color appreciation, with very little distortion of normal color values.

I think we might better appreciate this if we draw a diagram indicating the spectrum, the visible spectrum, that is, if we arbitrarily say it runs between 400 and 700 millimicrons. As you are familiar in the visible spectrum by day the brightest color by far, the most luminous color, is yellow, slightly greenish but on the yellow side. If we take that then as 100 per cent luminosity, we will find that normally we have a bell shaped curve, very sharply peaked in the center. At about 555 to 560, we find the most luminous part of the spectrum, that is, if we take equal amounts of light energy at varying points through the visible spectrum, this will have 100 per cent brilliance, whereas over here at the 400 millimicron wave length, at the extreme red end, we will find that the light is very dull.

These Calabar lenses were advertised to us as lenses which transmitted light similar to the normal curve. If we actually plot the transmission at varying wave lengths of the wave bends, we find the curve runs something like this. (Illustrating on the blackboard).

What the manufacturer says is true. It transmits light to greatest extent in the yellows and greens, but actually I don't think that is what we desire. In its selective filtration or comparatively greater filtra-

tion at the red and at the violet ends of the spectrum, it is acutally producing color distortion. However, that is the glass which was popular throughout the nation before the war and was adopted by the armed forces. You are all as familiar as I am with the trade marks of the young pilot at the beginning of the war. The Calabar glasses were just as much a part of his equipment, his necessary equipment, as was the convertible coupe.

Now that glass which was standard had a transmission of 51 per cent. That is over all transmission. We felt at that time that such a glass was desirable, that lenses, filters of greater density, were dangerous. I think those of you who have served with the Air Forces have noted the characteristics of pilots. They put these dark glasses on when they get up in the morning and take them off when they go to bed at night. In midday, certainly 51 per cent transmission or 45 per cent absorption is not dangerous, but at dawn and dusk, it might be dangerous, or certainly glasses of greater density would be. So we kept a very faint attempt there. It was a Calabar C, for those of you who are familiar with the gradations in these filters. This lens was found to be inadequate in the tropic zones and particularly in the Arctic zones, flying over ice, sand, snow, water and so on. It would seem then that a lens of much greater density would be indicated. Oddly enough, the old Arctic fliers, fellows like Joe Crossen, when they were consulted concerning sunglasses, expressed a preference for yellow, for the old amber. That seemed odd, Amber seems quite bright. The reason that has been advanced is that through its selective absorption of blue, amber lenses permitted the man in the air to differentiate better between blue ice white paint, and a snow field, or between faint blue water and snow. Through the selective absorption of blue, the glacial ice and the water were made to appear dark, thus drawing a finer line between blue and white.

Well, if amber is desirable, certainly it should not be a bright amber. It would seem then that it would be well to combine with the amber lens a neutral density lens, combine the two, make it a very dark amber.

It so happened that the Pittsburgh Glass Company at that time had a batch of glass long on hand. They had been unable to sell it, but its transmission curves matched almost exactly those which theoretically were desired. So the rose smoked glass was adopted and they used glass originally 21 per cent and later 15 per cent transmission. It has been standard issue since that time at the ports of embarkation.

Since V-J Day, a lot of that rose-smoked glass has been thrown on the commercial market and you will see them marketed everywhere.

We grant that amber lenses are of decided advantage in the Arctic, but I feel that amber still is uncomfortable for routine use. It would seem to me that this rose-smoked glass will have a rather short vogue. We will all go through it. Our patients will demand it for a while, but it would seem to me it would be much more desirable to get back to a lens such as was used thirty or forty years ago, a smoked lens, one a little bit more

scientifically produced than the smoked lenses were then. At that time, you will recall, the ordinary smoked lens had a very uneven absorption across the spectrum so that our blues and greens were accentuated and the reds were greatly absorbed.

The Bausch and Lomb people have produced gray lenses of a fairly even absorption across the spectrum. I think that very probably we will see these come into the commercial market in time, and it would seem to us at least that it would be a far more desirable lens than previously has been available to us.

Early in the war, it became apparent that our bomber pilots were suffering very heavily from enemy fighters attacking from the sun. A great problem then was to devise some type of goggle which would permit the bomber pilot to see straight ahead and yet would give him some protection when he was searching the area of the sun. That problem, of course, is not limited to bombardment type ships. All sorts of gadgets were tried. The British had a fairly effective one, a goggle with a black celluloid flipper which could be thrown down in front of the eyes by the pilot when he wanted to search the area of the sun, but that had its disadvantages, too.

Perhaps the lens which comes nearest to solving the problem is one which was developed experimentally not so very long before V-E Day and which has not been generally distributed. However, I think we will see more of it in the future, and I have a feeling that it has a very definite application in our civilian life.

I have here an ordinary pair of Calabar lenses, an experimental model, on which has been deposited, in the upper portion, a chrome nickel alloy It is so graded that its density opposite the pupil is nil, and its density increases greatly as we rise in the lens, so that it is so dense at the periphery that it is possible to study the sun directly. Perhaps it should be a little denser than this experimental model which I have here. I have worn this pair of glasses in planes and found them satisfactory there. I have also worn them on the highway and find they give me very great comfort when driving into the sun.

My own idea of the best sunglass for routine purposes will then be a gray glass of about, say, forty per cent transmission - 40 to 50 per cent - with a top graded chrome nickel density.

I have very hastily sketched a few of the developments in this field, gentlemen. We at the School of Aviation Medicine have not been responsible for the development of these. We have been curious in the development, but the credit for these developments should go to Aero-Medical Laboratory at Wright Field.

If anyone would care to see these glasses I would be very happy to show them. (Applause)

CHAIRMAN McDONALD: Is there any discussion of Colonel Matthews' paper?

If not, we are going to bring in a ringer this afternoon. You notice that Colonel Payne is down on the program to speak of "Recent Ophthalmic Problems in the Philippine Islands." He got back from a period of temporary duty over there just about two months ago. He, however, could not get here today. However, we are very fortunate in having with us Major W. P. Chamberlain, who has just come back from four years' service in the South Pacific.

I would like to call on Major Chamberlain at this moment for a brief discussion of some of the ophthalmological problems he ran into in setting up his hospital and how he came out during the long period of time he was over there.

Major Chamberlain.

MAJOR W. P. CHAMBERLAIN: Mr. Chairman and Gentlemen: I have no speech prepared. I should like to say that I am extremely happy to be here. I have to pinch myself about every so often, to be sure I am back. I am sure that Major Scheie and some of those who were over there a long time under more adverse conditions than I was can sympathize with my feeling.

I did have the pleasure of probably setting up the first eye clinc that was operated in the Southwest Pacific Theater. We landed in Melbourne the last of February 1942, and in fact, we were there before General MacArthur was there by some three weeks. I rather hesitate to discuss any of the conditions we saw, or I would rather say that I agree with what Colonel Thygeson has already said about the accentuation of so many of the common eye conditions under tropical conditions. It is not so much that the run-of-mine stuff was different from what we usually encounter, but they were certainly so much more severe. That was particularly true of the dendritic keratitis. We took care of the First Marine Division, when they first came out of Guadalcanal in 1943, and they were staged in Melbourne for quite some period. About 80 per cent of that Division, or more than that, were heavily infected with malaria. They didn't have their dosage worked out. Unfortunately, they had not taken the drug and these boys came down with malaria at surprisingly regular intervals despite active and careful treatment.

I was struck by the unusual incidence of herpes simplex keratitis in this Division as compared with the corresponding division we happened to be taking care of at that time. We found about six times as much herpes simplex keratitis in this Marine Division as there was in the National Guard Division that had not yet seen active duty in the islands where malaria was prevalent.

We spent two years in Melbourne. Then we went up to New Guinea, and perhpas the most interesting tropical disease that we ran into there was scrub typhus, tsutsugamushi fever, Japanese river fever. I would like not to say anything about that until after Major Scheie presents his paper. He has done a very good and careful study of these conditions and

my findings are very much the same as his.

I was only in the Philippine about three months. I didn't like the weather at all. I was very glad to be able to get out of there. I would rather confine my remarks to a discussion of Major Scheie's paper later. Thank you. (Applause)

MAJOR H. G. SCHEIE (Crile General Hospital) read his paper "Ocular Changes in Scrub Typhus." The complete paper has been submitted for publication and will be available for detailed study at an early date. His excellent work was carried out during his service in the China-Burma-India Theater from a most thorough study of many cases of scrub typhus from diffuse theaters of operations.

Major Scheie describes the external and internal ocular changes of scrub typhus in its different stages and points out eye findings which may be a factor in arriving at a correct prognosis in this disease.

DISCUSSION

MAJOR W. P. CHAMBERLAIN. I should like to congratulate Major Scheie on the excellence of his paper. I think you have to appreciate the difficult conditions under which he has worked and the difficulty in working with patients who are so completely prostrated as many of these in the acute phases of the disease are, to realize the amount of work that has been required.

I saw scrub typhus from the time we were in Melbourne, up through, well, I saw some even in the Philippines. I am firmly of the opinion that they are different, whether you want to call them strains of the typhus or not. They are not all alike.

Those I saw in Melbourne I never saw a single eye complication among them. Then when we got up in New Guinea, we had one group that came from Dutch New Guinea from the area around Zanzidar and that is where I ran into a large number of eye complications.

The mortality is another thing that varied greatly. We had one small outbreak about a mile from the Fourth General, where I was stationed, in Finschhafen, where only ten boys got it, but eight of them died. Yet other figures are quoted where they are as low as only two per cent mortality.

I would like to say, first, that I agree quite closely with Major Scheie's findings. What I ran into was quite similar with regard to the external examination of the eye. I saw three or four cases of eschar involving the eyelid. In those cases, they had the typical regional adenopathy.

In one case, I did happen to see two cases with quite severe uveitis, with typical corneal infection and posterior synechia where the iris is adhered to the lens. Those patients were transported to the hospital and the iridocyclitis missed. All these complications, including the iridocyclitis, came on definitely in that third week that was mentioned.

I agree also that the most severe and most consistent finding is the edema of the optic nerve spreading out on the retina. I saw many cases, perhaps not as large an incidence, of retinal hemorrhages and exudation as was mentioned.

One way in perhaps I differed a little from Major Scheie's findings was that we did find considerable enlarged blindspots in some of these cases. In fact, in all of those that were severely edematous, there was an elevation of a diopter or two; I would say there was a significant enlargement of the blindspot. I remember one of them from an average of 5-1/2 to 7-1/2 degrees was increased as much as fifteen degrees in diameter.

There was also one case which unfortunately I only examined once. He was a consultation case from another hospital, and like most interesting cases, that seemed to get away first. He has had a central scotoma in each eye with vision cut down to practically hand movements. Apparently his vision was quite normal before he came into the Army, and I could find no explanation for it, other than the typhus fever which was quite obvious. His eye grounds showed the usual edema, such as was found in the others that had perfectly normal vision.

There is one thing I would like to ask Major Scheie. You did have some cases that died, that showed relatively little retinopathy. I remember one in particular that I followed up to the time of death, and I could see absolutely nothing that I would pin my hat on as being abnormal fundus finding, other than perhaps slight engorgement of the veins, not the tremendous thing that we saw in so many of the other cases.

LT. COL. M. E. RANDOLPH: What is the general blood picture in these cases?

MAJOR SCHEIE: There was no essential change. Blood count doesn't help at all in diagnosis.

MAJOR R. C. LAUGHLIN (Edgewood Arsenal): First, I would like to say that I think this has been a very interesting and illuminating talk.

I would like to mention the fact that any patient who dies with a febrile infectious disease will show a round cell infiltration of the choroid. We have seen that a great many times at Hopkins, where they have taken routine eye sections from all

autopsy cases in which the brain was obtained. That will vary according to the acuteness and severity of the illness, anywhere from small patches to general profuse infiltration of the choroid, and very, very seldom does the fundus show any changes before death. Dr. Friedenwald has called that a septic choroiditis. I think he wrote a paper on it several years ago.

I would like to ask about the spinal fluid. You mentioned something about the meningitis which wasn't very clear to me. I would like to ask in the spinal fluid if there was any increase in the cells, and particularly in those cases that appeared to have some uveitis with some opacity of vitreous.

MAJOR GUNDERSON: I would like to ask a question about the retention of the cell that has been demonstrated.

Our hospital ran into true typhus on two occasions: First, in Morocco, in the winter of '42 and '43, where it was constantly endemic. It apparently is the time of the year when the Arabs drape their coats around them a little more tightly and the vermin inside proliferate and bite a little more ferociously. If you view one of these Arab pest houses, it is really something. They remind one of nothing else but a scene in the Old Testament, I should think. There are no screens on the windows, and there are very sick individuals lying on straw pallets around a huge room. Flies are so thick you can scarcely see the other side. Each one of these large wards is filled either with smallpox, typhus fever, plague, or a few lepers thrown in.

We were advised not to spend too much time over there because at that time it was not known as to the exact efficacy of the typhus shots we had all had.

I think it is tremendously significant that of true typhus fever, there was practically none in this fairly highly infected area. The same is true of the very large epidemic they had in Naples in the fall of 1943.

*LT. COLONEL TYGESON: (The reporter could not hear this question.)

MAJOR LEO J. CROLL (Fletcher General Hospital): I wonder if the edema or fundus picture has ever been explained on the basis of circular decompensation.

MAJOR SCHEIE: Major Chamberlain mentioned variations in the mortality rate as possibly being due to a different strain in the virus. We have some reason for thinking that it is not so much a matter of that as of the care the patients have had from the time they

* The question was in reference to seeing Rickettsia.

first became sick. We have run, roughly, three epidemics, if you want to call it that, or endemics. The first two groups were men who were in more or less the same part of the country as the third group. They were on the march all the time. They were Americans or Chinese in primitive jungle fighting. They had to march after they were taken sick. Many had dysentery and a good many had malaria. This group had a mortality (unfortunately I do not recall the figures) between 12 and 20 per cent, in these two groups.

The third group had a mortality I think of less than 5 per cent. They were a group of patients in the same part of the country, North Burma, a little further south, but a good many of the second group ended up exactly where they were and picked up the disease there in camp, training, having good food, sleeping regularly - if you call K rations good food. I think probably that is the explanation. They came in to us, developed a fever they might have a day, or go into the evacuation hospital, and the third or fourth day of the disease we would see them. Others we might see when they were ready to go into coma.

Also in our last epidemic we were able, through General Stillwell, to have put up an air-conditioned ward. We had a tough life over there. It was put up of bricks and was a beautiful air-conditioning unit. The sick patients were put in there, and that care was given to the group that had the low mortality.

That still doesn't definitely exclude the difference in strain which we certainly should consider.

The difference in our findings in blindspots, I cannot explain. I know the blindspots were enlarged probably two or three degrees, even four in some of my patients, but that was not a consistent feature. Some patients with a diopter and a half disk showed nothing significant. It might have been a difference in lighting or something else. I can't explain it.

Major Laughlin brought up the question of infiltration of the retina in patients who died of febrile illnesses. I am anything but a pathologist. They definitely felt that the infiltration was significant. I believe I am correct in this. Mrs. Wilder has seen a good many typhus specimens. She said they were typical molecular cells of this disease - not so much of this disease as I understand you see the same cells in rheumatic fever, not necessarily in the eye but elsewhere in the body. That is the only answer I can give to your question.

I neglected to answer Major Chamberlain's question about the normal retinas seen in some of the patients who died. I think I mentioned before that several patients - enough to ruin my statistics and make them very useless in that group - died before they had a chance to develop retinal changes. It is true that some, but I

think not many patients died in the eighteen or twenty days with normal eye grounds. Of course, they all died from one, two or three complications. It may be that for some reason the eye was more resistant to cellular infiltrate or the change that was going on in the choroid, I don't know.

The spinal fluid had no dramatic changes. The cells were increased and the protein was increased, but it wasn't a classical meningitis picture.

As for the Rickettsia, our studies so far and my slides are preliminary, and whether they will be able to really see Rickettsia, I don't know. Experimental work has been done, for instance, in emlusion of lymph node which has been injected in the anterior chamber. Rickettsia were in the corneal endothelium.

When we first went over, we were asked to send back to the States animals inoculated with Rickettsia. We inoculated several monkeys and we inoculated several rabbits. The rabbits were inoculated in the anterior chamber. Those animals had to go back to the States. Two officers had to go along to supervise those monkeys and rabbits.

So far as explaining the edema of the retina on the basis of circulatory decompensation, I don't believe you can do it, because so few patients showed the phenomena. A few showed edema of the ankles. Very few showed a classical picture of decompensation.

Did I answer your question, Major Gunderson?

MAJOR GUNDERSON: Yes.

MAJOR SCHEIE: Thank you very much for the discussion.

... The meeting adjourned at five o'clock ...

FRIDAY MORNING SESSION

Lt. Col. S. A. Fox, Newton D. Baker General Hospital, presiding.

LT. COL. N. L. CUTLER (Dibble General Hospital) gave talk on "Correction of Large Notching Defect of Upper Lid."

This title can probably be worded slightly differently. It should be labeled "The Correction of Large Colobomatous Defect of the Upper Lid," rather than a notching defect.

This is possibly a new procedure or at least another procedure to correct this type of defect. It is not my purpose to go into the historical aspects of lid surgery from the point of view of reconstruction of lids or parts of the, nor into the procedures which are in common use today and which you are probably all familiar with, except in so far as it applies to what I want to talk about.

... Colonel Cutler showed several slides ...

We have done three patients with somewhat similar type of defect. You are all familiar with Hughes' procedure, which he originally worked out and has thoroughly described in his small book, which applies to the reconstruction of the lower lid by splitting the tarsus, and so on.

I think it was in 1942 that McLean published an article in the Journal describing what might be called a partial Hughes procedure where the entire length of the tarsus being covered to the lower lid, a part corresponding to a defect was transferred down; that is, half of it was shifted down. By that means, you got tarsus and conjunctiva filling your defect and the skin defect was covered in any manner you would wish to.

Then I believe "Art" Sherman also did something of this kind, although I do not recall his particular article.

Our friend, Saul Sugar, whom I am sure you all have heard of, who was at Barnes in '44, published an article describing the same type of procedure for filling defects in the upper lid.

Then in about the last issue of the Journal, Hughes came out with an article on the reconstruction of the upper lid. I think he calls it total reconstruction, although it probably is not quite total reconstruction. This is the first time I believe that he has described any procedure for the upper lid.

The reconstruction of the upper lid in its entirety or in part I believe imposes difficult problems that differ entirely from the reconstruction of the lower lid. We have reconstructed some upper lids where there has been conjunctiva present, where there has been

no eye present by turning down the conjunctiva, doing a Hughes procedure, and moving the tarsus up a little and suturing it to the conjunctiva over a conformer and then putting a full thickness graft in part of the conjunctiva and it takes perfectly and they even shifted a pennant flap from the lower lid to gain additional space in the upper lid.

Hughes' procedure for the upper lid appeals to me as being a procedure for a reconstruction of most of the upper lid but not the upper lid in its entirety.

I don't think his procedure would be as simple as the procedure which we have used, if we were to adapt it to this type of defect.

If you remember he did a rather complicated reverse Hughes' procedure. In the first place he split the lid and then sutured the tarsus to the defect up here. After he had gained a little conjunctiva over the eyeball by shifting some flap from the side he moved the tarsal edge up to the top of his defect. That was a large defect and apparently he moved the entire tarsus up there. He would have to do that because the defect was so large. He also moved the skin up at the same time. He later put in a skin graft to get more lid, and he put in an eyelash graft and then in addition took a piece of tarsus with some conjunctiva from the other upper lid to get some tarsus in his lid margin here, and he ended up by having one and a half tarsi in that upper lid, as I see his description.

It seems to me that he has used more tarsus than would be necessary if we were to adapt his procedure to this type of defect. Later he, you will see, picked up the levator muscle under local anesthesia and sutured it also.

The Sugar procedure, which you might ordinarily think would be adaptable to this type of defect, as a matter of fact is not, because this defect, as it is here, measured 8x15, and when it was stripped up it measured 9x15. The tarsus in the upper lid averages about 18 mm. in depth, and in the lower lid about 5 mm. in depth. Consequently, if you are going to move your tarsus up, you have certainly a maximum of less than 5 mm. if you are going to leave some tarsus in your lower lid. In the upper lid, where you have 11 mm., you have a great deal of latitude and that is where certainly the Hughes procedure has worked so very well in the lower lid.

With a 9 mm. defect here to fill in, there is not enough tarsus available in the lower lid to fill in that defect, getting the conjunctiva and tarsus in place. The problem is essentially one of getting conjunctiva and skin to cover that defect and doing it as simply as it can be done.

I might say that this patient had a shrapnel injury which necessitated the removal of his eye overseas and caused this upper lid defect. As a matter of fact, most of our serious lid injuries do not have an eye present.

I believe that is a little more common in civilian practice to have an eye present.

At the same time, a skin incision is made at the lower border of the tarsus, and it goes right through into the socket, and then the skin incision is carried down, and then the skin is undermined from about 1½ mm. below the upper incision, and then undermined. The conjunctiva underneath the socket is also undermined. Then you have a flap of skin with conjunctiva attached at its upper margin. Parallel incisions are carried into the socket through the conjunctiva at each corner. Then that flap of skin is simply carried underneath this bridge of tarsus, carrying with it the conjunctiva and sutured in place in the defect.

This does not have tarsus in the margin. If you want to put tarsus in there, you can do a partial Hughes and take up a small piece of tarsus and put it in the lid margin. (Applause).

REPAIR OF LID MARGIN DEFORMITIES

LT. COL. S. A. FOX (Newton D. Baker General Hospital): Gentlemen, I have some slides of plastic procedures which we have done at Newton D. Baker. I suppose you might call them minor plastic surgery in comparison with some of the procedures which I am sure you will be shown. However, we thought it might be of interest to throw into the discussion some of the lesser plastic problems which are met by all ophthalmologists. I am sure you have all seen them at eye centers. I am sure we have met them or shall I say, tried to meet them. They are all, with the exception of three, battle casualties and we can dispense with most of the clinical history since I have a number of slides to show.

The first series is three or four of the ordinary small lid notches which are best corrected by the Wheeler "halving" procedure with which I am sure you are all acquainted. He has a small notch of the upper lid - a small notch with relatively little scarring - and after enucleation it is a relatively minor procedure to repair the lid by the Wheeler "halving," which I think is an excellent procedure. In these small notches you will remember that that comprises splitting the lid in the region of the small notch, excising a little sliver of skin at one side and a little sliver of conjunctiva on the other, and uniting by mattress suture, and a few skin sutures were necessary.

Another case. This is a perfectly similar condition, you see, but of the lower lid. This is the eye after 19 days of repair with a temporary prosthesis in the side. At this time, we were not making our own eyes but sending our men to Washington for temporary prostheses after repair, and then we had to send them in again for permanent prostheses, and, of course, that facilitated matters a good deal.

(Slide) This is another small square notch converted into V Shape and prepared in the usual manner.

Here is another adhesion of the lower lid. This is one of the three. He gave a history that he had noticed this within the past six months. We took out a wedge with about one centimeter at the base, at the edge of the lid, and threaded it in the usual fashion.

We come now to the more complicated notches. These are the larger notches which I think even Wheeler himself said his procedure was not quite so adaptable for the smaller ones. I think Captain Sherman will bear me out on that. In these cases you have a lot of loss of tissue and scarring. By the time you get through dissecting if you are going to do the drawing over, you will have a shortened lid.

We have adopted a sort of modified Hughes procedure. I suppose you would call it, for the repair. What we did in these cases was to split the lid in the region of the notch, then draw up a sliding tarsal conjunctival graft, enough to fill in the notch which had been converted into a square notch in the tarsal conjunctiva only, and draw that up and out through the skin of the lid. Then another double armed suture was passed through a peg, and then passed through the skin edges, and then carried down in front of the tarsal conjunctiva sliding graft, and the closed procedure like this. This represents the double arm suture in the tarsal conjunctiva graft which has been brought up from the lower lid, and these two represent the closure of the skin. This is in the upper lid, of course, and this in the lower.

Of course, not all of these are perfect results. I would be the last one to deny that, but some come out fairly well. We feel the virtue of this operation is that you do not shorten your upper lid, and especially if the notch is in midline you have no additional scarring from surgery of the skin because the only skin closure that you have is this in the middle line that you would have anyhow, and the cuts are in the tarsal tip and not the skin at all.

This case was a little bit deceiving (referring to another case) because when we turned his lid out there was a mass of fibrous tissue which on excision left us only half of the tarsal conjunctiva in that thick lid. We felt in this particular type of lesion, the procedure I have presented is typically adaptable because if you were to close that without drawing up a sliding graft of tarsal conjunctiva, you would have a very much shortened upper lid.

We have done about 21 or 22 of these cases.

Now we come to a different type, also I presume a minor lesion. That is these notches or defects of the lid in the length of the lid rather than in the width. You see, when the lids are closed, he has a sort of crescent shaped dehiscence in the upper lid which we proceed to repair in the following manner. The lid was split into the usual skin

muscle and tarsal conjunctival layers and the opposite lid was denuded of epithelium, and the two sliding grafts were created. The skin was just a little bit outside of the other one to retain a graft effect. Then those two flaps were drawn down so that the greatest indentation was at the level of the normal lid, and that was resected, and then the two flaps were sewed to the denuded lower lid by three mattress sutures.

More recently, we decided that we would discontinue this particular procedure I have just described, and we decided, if we were going to do lash grafting on these cases with these small lesions of the lids, we might do it all in one big stage rather than in two, so we adopted a little different procedure.

The procedure we adopted was to split both the lids in the area of the lesion, to split the lower lid only into two layers for about a millimeter and a half, just to give us two layers and not to mobilize the lower development. Now the upper lid is split, where the lesion is, and undermined upward, so the tarsal conjunctiva area can be drawn down and sutured to the tarsal conjunctiva of the lower lid.

Then a hair-bearing graft is taken, partially hair-bearing and partially clear skin and planted right over that.

Anyone who has done a lot of lash grafting, hair grafting, will know they tend to fall out in about ten weeks and in ten or eleven weeks later they start coming in again. (Applause)

... Captain A. E. Sherman, O'Reilly General Hospital, presented his paper on "Choice of Procedure in Ophthalmic Plastic Surgery." The following is a summary of this paper:

During the past one and one-half years, we have had about 350 cases for ophthalmic plastic surgery, of which there are about 150 remaining for further surgery.

The following procedures have been most useful:

1 Wheeler's "halving" type repair for notch deformity of the eyelid with accompanying vertical scar, also for traumatic colobomata of the eyelid.

2. Wheeler's method of free skin or Wolfe graft with lid adhesion for cicatricial ectropion or lagophthalmos. Upper eyelid, cephalo-auricular angle, and supraclavicular area is the order of choice for the donor site.

3. Wendell Hughes' method for reconstruction of the entire eyelid.

4. 2 to 3 mm. wide strips from the mid-portion of the eybrow for eyelash grafts; 6 mm. wide strips from the occipital scalp for eyebrows (Lexer - 1923).

5. "Z-Plasty", or interposition of flaps for eyebrow deformities. Also useful for moderate degrees of epicanthus.

6. Resection of the levator and tarsus for traumatic ptosis, especially if accompanied by anophthalmos. (Wheeler - Blaskovics).

7. Lid adhesions or partial tarsorrhaphy for facial nerve paralysis which may recover; lateral canthoplasty and lateral transplantation of the cantal ligament for permanent facial nerve paralysis.

8. Kuhut-Szymanowski procedure for relaxed lower eyelid.

9. Removal of the tear sac, scar tissue, and displaced bone if necessary in order to re-anchor the canthal ligament in fracture deformities of the medial canthal area.

10. Grooved glass sphere implants for retracted socket following simple enucleation.

11. Wedge acrylic implants to the floor of the orbit to correct or lessen retraction of skin below the brow in cases of evisceration or enucleation with small implant. Also instead of cartilage grafts for depression of the globe following fracture of the floor of the orbit.

12. Mucous membrane grafts for cicatricial contracture of a portion of the eye socket.

13. Wheeler's method of entire relining of socket with thin Thiersch or epidermal graft for extensive contraction of the socket.

14. Fascia lata as a filling material for small depressions due to small loss of the orbital margin.

15. Iliac bone grafts for larger losses of bone.

Procedures that should usually be avoided are:

1. The "Esser inlay" graft to replace eyelid skin.

2. The use of pedicle flaps from the area round the orbit to replace loss of eyelid skin.

3. A continuous piece of Thiersch graft for the eyelids and nose.

4. The combination of Thiersch graft in a socket with normal conjunctiva.

When there has been extensive loss of tissue so that the best results one could hope for would be immobile, unnatural eyelids with a staring conspicuous artificial, it is certainly better judgment to remove the remains of conjunctiva and lacrimal gland, and cover the orbit with a continuous layer of smooth skin.

... Lantern slides of 28 illustrative cases ...

LT. COL. FOX: I envy Captain Sherman his results. I envy him almost as well his ability to follow his patients. Some he has been following for over a year. In over 200 cases of plastic surgery, we had at Baker we were not able to hold them more than six months.

OPHTHALMIC PLASTIC SURGERY

CAPTAIN ALSTON CALLAHAN (Northington General Hospital): Gentlemen: This is part of a paper that I gave at the Southern Medical Association early in the month, in one of the "Southern" cities - Cincinnati. So the War between the States actually is over.

I am going to show only four cases, so I am cutting the paper very sharply and just giving you part of it. They are four typical cases, such as we have handled at Northington General Hospital in Tuscaloosa. I don't think there is anything new, except perhaps one or two remarks about our particular experiences.

(Slide) This soldier was riding in an armored car when a shell fragment exploded nearby, causing third-degree burns of the face and left upper lid. Immediately surgical repair was given at the Eighth Evacuation Hospital. On admission to our center four months later, it was noted that on rotation of the eyes, the left lid did not completely cover the cornea. At surgery, an incision was made through the skin of the upper lid and continued downward to outline the pedicle in the lower lid. This pedicle was dissected from the underlying tissue and moved into the incision in the upper lid. The flap was, therefore, not severed from all nutrition. Adhesions of skin and subcutaneous tissue were made between the upper and lower lids. The appearance one week after operation and immediately prior to the removal of the sutures is shown.

(Slide) The lids were held in contact for nearly five months by these surgical adhesions.

(Slide) We start out using adhesions for three months, and we found some small retraction would occur, so our usual length of time is to leave them four months, and in a few cases, five months.

(Slide) After the adhesions had been together for over four months, we did divide them and the last picture in this group shows the final appearance. (Slide)

(Slide) The next is a case of free skin graft. This is one of those cases of atrophy of the upper lids. We see it very often in airmen whose planes catch fire. It is possible in these cases to see where the helmet covered the part of the forehead. Those of you who are up close can see where the helmet extended and also the oxygen mask covered the nose and cheek and protected part of the lower lids.

This airman was not wearing his goggles when his plane caught fire. A very interesting finding that usually occurs in these cases was a burn of the right hand, because when the planes are hit the men slip the glove off the right hand to prepare their parachute to bail out, such as this man did. You will notice that he has considerable contraction of the upper lid and also that he has some photophobia from the photographic lights.

(Slide) This shows that on forcibly closing of the eyelids, there was a considerable amount of cicatricial tissue present.

(Slide) A photograph taken from the lower angle, with the patient looking down, shows the exotropia of the upper lids.

(Slide) This method has already been ably shown in some of the previous discussions. This shows how we put in the tarsus. The lateral one was wider than the medial one, in order not to get too close to the area of the punctum.

(Slide) This shows the sutures tied in place, and the next slide shows the free graft transplant. It is our usual procedure to put in alternate long and short sutures so as to tie the long sutures over a mold. In this case skin from the cephalo-auricular angle was used on both upper lids.

I would also like to say that the right upper lid on this case was performed by Major Clark, the previous chief of this service, and I drafted the left upper lid.

(Slide) You can see that on closure of the lids, there was ample amount of skin present and that on downward gaze, the atrophy was no longer present.

This airman was one of those men who was shot down in the first raid over the Polesti Oil Fields, and his initial treatment at a Roumanian hospital was very inadequate.

(Slide) Here we have a case of a soldier who was burned by a booby trap, a barrel of tar, which gave extensive burns of the face and the neck and arms. Strange to say, the vision in each eye remained at 20/15, but, of course, there was great danger of exposure of the cornea because when he closes his eyes you can see that the mucous membrane, the conjunctiva, turned inside out.

To repair this defect, we used a dermatome to remove skin from the abdomen, and we did a free skin transplant of all four lids.

(Slide) You notice that the tarsorrhaphy has opened on one side. However, the cornea was well protected. This case naturally went outside of the usual limits of plastic ophthalmic surgery, and we asked the general plastic surgeon to assist us, which he did, by bringing up a brachial tube.

You will notice also that we have already divided the tarsorrhaphy of this eye, because as this tube is divided here and swung up into position, we wanted to be sure that we had supplied him with adequate skin. You can see that he has a slight droop near the medial end of the lower lid.

I do not have the rest of the slides in this case because it has not been completed.

(Slide) The last case which I am showing is a case of a deformity of the inner canthus. We have found many cases of deformity of the inner canthus, and, of course, it may be true that our surgical technique is not as efficient as it should be, but we have not found a gratifying result in all of the cases which were treated in the method which Wheeler described in using a suture through the ligament or through the periosteum. Therefore, after several unhappy results - although we mobilized the lids and on one or two occasions actually divided the actual canthal ligament - we still could not attain enough freedom of lids for it to be held at the inner canthus.

One particular case was an early casualty in France. In some of those days, the men who saw the cases did not have conformers to slip inside the socket, and also they did not, in some cases, suture the canthal ligament or suture the canthus to the tissues near the nasal bone. So these cases in some instances developed a very small lid, a very short lid, just really a lid in miniature. All the cilia was there but the lid became very shortened. There is a defect of the frontal area, just above the glabella, which was the exit area of the shell fragment which struck him.

This patient also developed chronic dacryocystitis. It was decided best to remove the lacrimal sac.

(Slide) At surgery, the lacrimal sac was removed and two small openings have been drilled with a dental drill at the posterior portion of the nasal bone. A piece of tantalum wire was introduced through one of these openings, and with a Tyrrell's hook, it was brought out of the other opening. Then using a small needle, the tantalum wire was brought through externally at a region just medial to the punctum, and these walls were tied tightly together.

The wire was twisted, a rubber peg was put in, and the wire was twisted so as to pull on the stretcher, the lid over to the bone.

(Slide) This picture was taken about two months later. This wire was left in place for about six weeks, and then it was easily removed and the medial canthus remained in its proper position. When a plastic artificial eye was inserted, it was possible to show that we had moved the canthus over into position and almost as high as the fellow canthus. (Applause)

DISCUSSION

LT. COL. S. A. FOX: I have just one or two comments to make. I was glad to hear that Captain Sherman had his difficulty with hair-bearing grafts the same as we all did, I guess. Rarely, you are agreeably surprised with them. A little bit more often you are very disagreeably surprised. I think most of the time you just get a sort of mediocre result, neither good nor bad. However, we all keep doing them.

For raising the external canthus, we have modified the procedure a little bit. Instead of taking our wedge out from the center, we take it out from the external canthus corner. Especially in these lids that are rebuilt sometimes you get scarring where you won't in the healthy lid. We find it is less noticeable that way.

We have been planning in our lower lid reconstructions to get further and further away from the Hughes procedure, as far as drawing down a tarsal conjunctiva flap in the upper lid is concerned. We simply split the upper lid a little bit, just enough to give us two edges, draw up the edge of conjunctiva, edge of the upper lid, and whatever method you proceed to do after that, whether you draw up a sliding skin flap or you do a free skin flap. We have found that the skin that you replace, the lower lid skin, which is usually so much heavier and thicker, that tarsal support is not necessary. Therefore, we have gotten to the point where we leave the upper lid alone in its normal anatomical relationships.

LT. COL. M. E. RANDOLPH: I would like to say that these procedures, the four that are shown today, are absolutely outstanding as far as I am concerned. We do a tremendous amount of plastic surgery around the lids at Valley Forge, but without pictures to back up our results, it is sort of ridiculous to discuss our cases. There are a few points which I would like to mention, several little procedures we have found useful.

I wanted to ask Captain Sherman particularly about lid notching. In my early attempts up there, I was not completely satisfied after closure of one or two, and later went ahead and made a small incision at the lid margin and buckled it out in that manner. Wheeler used to do that.

CAPTAIN SHERMAN: You mean make ridge margins?

LT. COL. RANDOLPH: No, work at the upper lid, right at the lid margin, making a small incision and ending up outward like that.

CAPTAIN SHERMAN: I think the only time I know of our doing anything like that was with the Hatch repair. Sometimes it is well to diverge your incisions through the tarsus, so when you close you will get that little effect at the margin, simply because as these divergent pieces of tarsus come together they do that. I don't know of anything else.

LT. COL. RANDOLPH: We found that to be practical. I was most interested in hearing the remarks about repair of the inner canthus. To my mind, that is one of the most difficult procedures in plastic surgery around the lids. I was particularly interested in your case where there was complete loss of the lower lid. Rather than do the Hughes procedure, we have been making an incision along the skin margin, where the skin begins, and using that eventually as the lower lid margin, turning the whole lid up, putting a large graft below, and, of course, within the margin of the adhesions. That has worked successfully in a small number of cases.

Then, finally, the procedures of contractions within the orbits, the socket. Very often incising these contraction bands one way and closing them another with conformer has proven most satisfactory.

LT. COL. FOX: I would like to ask the other three essayists and any other member of the audience what their relation is of mucous membrane versus split skin grafts. I am afraid we lean a little bit away from Captain Sherman's idea. We like to do split skin grafts wherever we can. Certainly in reconstruction of the lower cul de sac, we found that to do one mucous membrane graft is not enough. We will have an eye out and the lower cul-de-sac must be good and deep. It doesn't matter so much about the upper cul-de-sac. I have taken a piece of mucous membrane and brought it right down to the frenum. You can get an uncontracted piece, possibly an inch and a quarter long and approximately three-quarters of an inch wide. We have found that they will contract sometimes. I remember one hectic two weeks when we did nine or ten mucous membrane grafts, and we found about half of them not enough, so we had to go in and do them again. So wherever we have had a reconstruction of complete cul-de-sac, we have leaned toward the split skin grafts rather than mucous membrane.

I would like to hear some comment on that.

LT. COL. CUTLER: We have used that reconstruction of the lower fornix, and we have a piece of curved plastic with suture holes in it which we put in the lower fornix with three mattress sutures which we bring out low down and maintain a fairly good stretch and an even stretch on that conjunctiva. We have found that it has given us consistent results.

Before that I have used mattress sutures and conformers but we found that curved piece of filling has worked very well. We have had no reason to abandon the mucous membrane in that condition.

LT. COL. RANDOLPH: I would like to ask one question. Has anyone done any work on reconstruction of the lacrimal sac and the canaliculi? We are running into cases like that, and we hate not to do anything about them. I wonder if anyone here has had any experience in that.

LT. COL. FOX: I can tell you I have tried two cases but they were unsuccessful, by inserting wires. Of course, the trouble is that we get these cases not fresh but four or five or six months after trauma.

LT. COL. RANDOLPH: Has anyone done the procedure that Guy reported several years ago, of the mucous membrane over a piece of acrylic or piece of metal or rubber tubing? That seemed to be quite successful in the case he reported.

DR. RUEDEMAN: I have been successful in two cases of the canaliculus. In one we put in an ordinary silver tubing with mucous membrane over it, laid in the sulcus below, and stuck in the lacrimal sac, and that took perfectly.

Recently, we had another case of one of our fellows in the hospital who had a severe lacerating injury down through both canaliculi, and we opened that one up, put a piece of heavy tantalum wire with some of the mucous membrane over it, and that is functioning all right, too. You stick them down in and take a piece of tubing, and if you can establish a fistulous tract, it isn't hard to maintain them.

MAJOR CAVANAUGH: I have had three cases where the patient had a tear between the punctum and the sac. I take a needle and find an opening in the sac and pull the needle right out with the skin and go through the upper portion of the sac. I put fish-lines together, place it along, until finally I have nothing but an ordinary straight needle between the punctum and the hole back through the sac. I left them in eight or ten days, and all you have to do then is pull back on that portion of the needle. The three cases worked very well.

We have had a few diagrams. If you have ever gone fishing and laced a couple of lines together, that is the principle of the thing. It gives you an opportunity. You have a solid bar there to suture your torn canal into, and then you know if you do suture together that the

continuity is going to be maintained.

... Major Cavanaugh spoke from the back of the room and the reporter could not hear ...

MAJOR O. L. WITTER (Dibble General Hospital): I think that we have learned from the general plastic surgeon a great many things not to do. They bear repeating.

One is that the graft should not be made larger than the defect.

Another is that the graft should be made as thin as possible.

Another is that all subcutaneous tissue should be removed very carefully.

LT. COL. FOX. I agree with that, because unless you remove all the fibrous tissue you are going to get contraction, and that is probably where we fell down on the mucous membrane.

MAJOR WITTER. Apropos of making free skin graft, I think Wakeman brought out a nice trick. He prepares his defects, then incises in radial, so you get a much larger defect to fill than with your scar tissue. He then places the free skin graft on that prepared area. When that has healed, he rolls it over, by regularly incising the skin and placing the skin graft suturing down. When it peels you have an edge which is rolled and thickened, but in two or three weeks that all becomes flattened down, and you have a much larger area and much freer lid. It has worked out very nicely.

CAPTAIN SHERMAN: Someone brought up the question of time of holding these cases. Naturally we have had cases on hand for over a year because, when you have to do seven, eight or nine operations on them, there has to be a waiting period frequently between operations. I don't see how many of them can be put through faster and still get a satisfactory result as we would like.

I think that has been one mistake, that very often one tries to do surgery too soon in some of these cases. Nature helps a great deal sometimes in the body healing process, even over a period of several months after surgery.

Regarding the time for the lid adhesions, I think that Wheeler's statements about that still hold true, and I think you will find with lid adhesions in place, provided you have had a good bed for your graft, about a month after the graft is put in, it probably looks its worst. It is trying to contract a little. It still sometimes looks rather congested and during the next two months, there is a stretching of the graft and smoothing of it. Possibly massage helps. I have a boy to do it. I don't know whether it makes much difference. I doubt if it does. In about three months time that skin begins to look pretty soft and smooth and has a good color and appears like normal skin, and also you can usually find that by pushing on the opposite lid and having them look up and down, lid adhesions no longer are needed to hold that lid in position.

With the upper lid very often under proper conditions two months probably is all that is needed for the lid adhesions. I would say usually there is no necessity at all in leaving the lid adhesions in longer than four months.

There is one little trick I didn't mention that I am sure most of us are familiar with. When putting a graft in the lower lid it very often helps I think to leave the lid adhesion suture long and run it up through the brow and tie it over wherever they are drawing the lid borders up slightly not too much using a little larger graft than the defect would be if we didn't do that.

I don't think there is anything more to say about the lid notches. I think ordinarily if you can get rid of the scar tissue whether it be upper lid or lower lid provided your incision is through the tarsus as they extend from the tarsus do not converge. I think you can get a very satisfactory result and there shouldn't be any tendency for the notch to recur.

I think it was Colonel Randolph who mentioned reconstructing the lower lid making an incision a short distance below the margin and doing intermittent tarsorrhaphy there and joining it to the upper lid and using skin graft below. That I believe is the way we used to handle those cases before Hughes came along with his procedure. I think I recall his using that once or twice. I personnaly think the Hughes procedure is a little better for it.

Regarding Colonel Fox's remarks about mucous membrane in the lower cul de sac I think you have to take a pretty large graft there sometimes. I also think that the section should not only remove scar tissue in that region but normal conjunctiva above the back part of the socket should be undermined somewhat and the section should go right down through the bone. When you use your form of dental molding compound it should hold that mucous membrane graft. Even though it may pull the conjunctiva to the back part of the sac you undermine a little bit it should hold that pretty close to the floor of the orbit.

I will admit there is lots of trouble with those grafts about the third week. They will try to contract and I have sometimes had to make another mold out of general molding compound a little bit smaller so that they will still be put in and out and stay in place properly but usually if you can struggle past the fourth week with them I think from then on they don't try to contract although they may stretch a little bit.

I prefer not to shift over to the acrylic for as long a time in there as I can. If I can keep using that general molding compound form about four weeks they usually do very well.

Colonel Cutler spoke about using a curved piece of plastic. I have used that in cases where the eye is still present, in which there has been a very bad ectropion, involving practically all of the lower cul-de-sac and there is not enough conjunctiva available even by sliding flaps to take care of it all. I never used it in anophthalmic cases. I think it is probably a very good suggestion. I have used it in cases that had the eye present. I haven't dared leave it in longer than the first dressing, even though it is down below the cornea. The sutures that hold it in place - possibly I have tied them too tight - seem to want to cut into the skin even with pieces of rubber on them, so I have usually taken that out.

Regarding the size of the graft, I think that is a very good point. I think that one should usually undermine the skin surrounding the area. I don't mean up toward the lid margin. I don't think that should be done to speak of, because it interferes with the lid adhesion sutures. It should be undermined below, so the skin can contract a little and in that way you use a graft about the size of the defect. I don't think it is necessary to use it larger. I think the lid will take care of that for you.

I don't exactly like the idea of making those other incisions and trying to use a large piece of skin. I don't think it is usually necessary to use more skin, when you remove the scar tissue, especially if you are using good eyelid skin for your graft. I know that the general plastic surgeon always feels he has to do something like that. I think it is a hang-over from some of the older methods, such as Astersion's and Dilly's, where for some reason they would not use lid adhesions and have to put in more skin.

Regarding Colonel Randolph's question about canaliculi, we had one officer who had a lower lid that had been torn loose at the medial canaliculus right through the canaliculus, very similar to one case I showed you there. His upper canaliculus didn't function well either. It had been torn. When Major Swift repaired that lid, we cut a piece of gold orthodontia tube, which extended from within his punctum down to the canaliculus, through the torn part over toward the nasal sac, and went on into the sac. We just left it there. After about two months, we sent him out with it in there. The tears were running through it.

It so happened that about a year later, he visited us, maybe not quite a year later. It still looked just the same, and he is perfectly happy with it.

Since that time, we have actually forced the passage in some of those cases through the scar tissue, where the lid is already up in position but the canaliculi is scarred in that area. We have used a large spinal needle, about 18, and pushed it in the direction of the sac, through the scar tissue, in the canaliculus, and then we can draw the stilet and determine by irrigation while we are in the sac. Then we put a piece of heavy tantalum wire through the needle, draw the spinal needle, and pass a piece of this orthodontia tubing. We have different lengths on hand. We pass it in there so it goes into the sac and comes through the canaliculus just about to the punctum.

The main trouble we have had with them is that the ends of them apparently push into the soft tissue and they don't function too well. Even though we have left them in for two months or even longer than two months, we take them out and we don't get a big opening there.

I think possibly that is one solution, provided we have the dentist use one of his little grinding drills and make a couple of openings near the end of the tube, so the tears will drain through there. It can be left in place and it doesn't cause any reaction.

LT. COL. FOX: I think I was the one who made the comment, Captain Sherman, about keeping your patients long. What I meant was that after the last operation, you said there were one or two that you had a year after your last procedure. That is what I envied.

CAPTAIN SHERMAN: Some of those have gone from our service over to another service. They had other work on other parts of their body.

LT. COLONEL CUTLER: There is one thing that I think has not been touched on here. We have maligned the plastic surgeons, and they are not here to defend themselves. I think we have a lot to learn from the general plastic surgeons. I think I have learned a lot.

One thing I think the plastic surgeons can show us is the use of skin flaps. Properly placed and properly sutured, they look very good, and they accomplish a result which you cannot get with a thin skin graft.

On occasions, I have carried the skin graft too far away from the lids. Before you get the orbital rim in some cases you are getting into fairly thick skins. Those conditions where the skin is thicker are better corrected I think by rotating the skin flap, down here on the temporal side, getting skin of approximately the same thickness.

We have had some large defects where the skin has been thick and we have been encouraged by that procedure.

Another thing is that oftentimes in the lower lid and toward the outer, you can get relaxation by pulling a crescent shaped flap more or less along the procedure Wheeler used in reconstructing a part over the lower lid. Wheeler has made a very important improvement in that particular procedure, in that he used tension sutures on this skin.

The type of case which we have had to some extent has been with the outer canthus very far down. We have been able to rotate the skin of the cheek and bring that canthus up, and in other cases where there has been a scar coming around this region or down this region, we have corrected it. We have made a cross incision, putting the point of the scar, the point you want to get the greatest elevation, and then overlapping two pennant flaps. You measure the width of the flaps, and you usually have relaxation in this area.

We have done a number of cases in that way. It is better than putting in skin. Oftentimes in the neighboring skin, you have the best skin you can use. I think we have been inclined to forget that. I think we have been inclined to use our skin grafts in the upper lid, a little too far away from the lid on occasions.

CAPTAIN ALSTON CALLAHAN: I would like to say, in response to Colonel Randolph's question, that we have used in one case a small silver tube, attempting to open a canaliculus, which was not successful, and in three cases we used a tantalum wire completely through, down through, and out through the nose and tied together. These cases had a good deal of cicatricial tissue in the canthus because of the injury from shell fragments, and hoping to correct it, we left it in place for four months in three cases. We took the tantalum wire out. The first two or three days, it drained very well. After that, it didn't drain through any more.

... The meeting adjourned at twelve-fifteen o'clock ...

FRIDAY AFTERNOON SESSION

Lt. Col. Edward E. Burch, O'Reilly General Hospital, presiding.

TRANSPLANTATION OF VITREOUS

LT. COL. N. L. CUTLER (Dibble General Hospital): I am going to more or less report on this paper that I have submitted to Washington on the "Transplantation of Human Vitreous" as a preliminary report.

I suppose I ought to start out by saying that according to Rindlaub and Fisher, vitreous is a metamorphic sol gel, isodynamical in form in a dynamic state. I wasn't going to say that, but after having come to the meeting, I changed my mind.

Put in plain English, it means that it is an unstable colloid which can be shifted from a gel to a sol apparently very easily, and that under the ultra microscope, it is composed of fibrilla rather than lamellae of unequal length.

About eight or nine years ago, I decided to see if I could transplant the vitreous from one eye to the other of rabbits, and this paper was not published, but I think I worked with approximately 50 rabbits, and I found that I could transplant approximately four tenth of a cubic centimeter of vitreous by means of a syringe from the eye of one rabbit to the other eye of the same rabbit, or to the eye of another rabbit, and that nothing seemed to happen out of the ordinary. The eyes quieted down very quickly. The tension remained normal. The eye followed the tension. Fundus examination also was unchanged. There was occasionally a small floater, and I had some of the eyes sectioned and the retina and other structures of the eye were normal.

Four-tenths of a cubic centimeter of vitreous in a rabbit is approximately all that can be transplanted.

I had in mind doing some things which being in the Army has offered me an opportunity to do, and that was to do the same procedure on some human eyes on which it appeared to me to be indicated.

I had been unable to find in the literature any reference to any article or description where this had been done on human eyes. However, there were other things that had been done along this line. They were done with the attempt to provide a clear vitreous in patients who had opacities of the vitreous. Many of these articles were not very complete in their observations. In fact, practically all of them were not. However, one of the first times anything of this kind was done was in 1890,

when a man by the name of Ford withdrew vitreous from several eyes, the loss, of course, being made up by the aqueous, and reported improvement in one case from light perception to 20/60.

Deutschmann in 1906 reported on the injection of vitreous from calves and rabbits into human eyes with treatment of the detachment of the retina. Of 67 cases, 26 were purportedly improved and 38 unimproved. Komoto, in 1910, reported on the withdrawal of the vitreous and injection of saline, and at the same time Elschnig reported on the injection of air.

Similar procedures have been reported by a number of authors, particularly between the decade of 1920 to 1930. They all reported improvement in some cases. Zur Nedden probably is the person who has treated the most cases by withdrawal of vitreous. He reported on some 300. In all of these cases, the observations were really I think not complete enough to give you enough assurance to do the procedure.

I decided to try this procedure on patients who had hemorrhages of the vitreous. I think there is a great deal that we do not know about vitreous. There is a great deal that we don't know about hemorrhage in vitreous. We know that in some injuries, not penetrating but contusions, the patient may have a severe hemorrhage in the vitreous. The tension may remain normal for a considerable period of time, and even the light projection will remain good, but the eye will go downhill. It will become soft, light projection and eventually light perception will be lost, and the eye will look soft.

In other cases, the hemorrhage will absorb over a varying length of time, and a person may get eventually possibly even a normally functioning eye.

In other cases, the hemorrhage may absorb, and you will have retinitis proliferans evident in the fundus.

In still others, the absorption of the hemorrhage for some reason is long delayed and apparently in some cases it seems indefinitely delayed. The light projection will remain. The tension will remain normal.

We have probably all seen hemorrhages that have been present in the vitreous for many months or a year, and then show evidence of clearing and continue on to where a person will get quite satisfactory vision, 20/40 or better. Why this is so, I do not know. If some of you have some ideas or information, I certainly would be grateful for it.

The problem of what eyes would be suitable to try this procedure on is not easy to decide, because in the first place you are working in the dark. You cannot be sure that you do not have a detachment of retina and, of course, you cannot be sure that there are not bands in the retina.

The procedure was fairly simple, and I don't think that it is entirely satisfactory yet. We closed the eyes that had had a hemorrhage in the vitreous which had not absorbed or had any improvement of vision over a period of several months, but in which the tension was normal, and in which, in general, we considered the light projection good, although there was one of these cases where for some reason or other the light projection was not tested.

I have done the operation under local and general anesthesia. I don't think it makes any difference. It can be done under local quite well.

Perhaps I might say that there are a lot of things that I don't know and I guess that are not known. There are a lot of things that we are trying to find out. One of them is how long we can keep the vitreous and still use it.

Then, of course, there is another. We don't know whether we can make repeated injections or whether we can use injections of mixed vitreous, but if vitreous is a sol gel, I believe we should be able to keep it under the proper conditions. However, in these operations we remove the eye of the donor patient and put it in saline at 370° and keep it in an incubator until we are ready to go ahead with the recipient's eye. Then we make an incision in the equatorial region of the donor's eye and using a 5 cc syringe, and a No. 18 needle, we withdraw as much vitreous as we can. As a rule, that is 1½ or 2 cc. The central part of the vitreous is fluid enough to be drawn up into that size needle and the peripheral part of the vitreous is not. Then if it is clear, we proceed with the next part of the operation.

The eyes that we have used have not been ideal. We have used it in eyes which we considered it was probably the only chance, and I think that has probably affected the results. The reason I mention that is there is a problem of withdrawing vitreous that has had hemorrhage in it.

In some cases, we made a ring of diathermy holes in a quadrant in which we were going to withdraw the vitreous approximately two weeks before the operation. However, we have not done that in all cases. The reason for putting those holes in two weeks beforehand is to create the adhesions solidly before we go ahead with the next step.

We made a small incision, after exposing the sclera, with the cataract knife in the equatorial region of the recipient's eye in the quadrant in which we thought the greatest density was or the region in which we thought we could get the vitreous out from. The incision was made down to the choroid, and then mattress sutures were placed on each side of the incision.

I have changed the method of putting these sutures in a number of times, and each time I thought I made it a little better. Sometimes some methods of putting it in were discarded. The latest way to have been doing it is to use about a 4-0 nylon suture and pass it through the outer layers of the sclera, approximately a millimeter and a half incision, and then carry it through the edge of the incision, across to the other side, and in the edge of the incision on the other side, and then out about a millimeter and a half on the other side. I have put a similar suture across that way.

The reason for that is to try to make a watertight joint around it. I didn't have much trouble with rabbits in making the watertight joint, but I have in humans.

Major Gunderson made the suggestion that I have a knife made which would give an incision which would just accommodate the needle. I think that has some advantages. There is one other thing I think will be advantageous, and that is to have a tapered needle, because there is some value in having a watertight joint, although it is not necessary.

I have used a size 15 needle, specially sharpened, on a 30 cc. syringe, to withdraw the vitreous. The reason for that is to give a little more suction than you would get with a 5 cc. syringe. However, there certainly is a limit to how much suction you should put on, because you probably can cause a detachment of the retina and I don't think that we have caused one for that reason as yet.

The assistant holds both ends of the mattress suture and then the operator inserts the needle toward the center of the eye and, under direct observation of the assistant, withdraws the vitreous if he can. The needle is very easy to see and if you have some of these very gelantinous clots you can even see it plug up the ends of the needle.

If possible, one and a half cubic centimeters is withdrawn.

Then the syringe is removed and the smaller syringe which you usually need to have the adaptor to fit the 15 size needle is fitted and the assistant puts traction on the sutures and the vitreous is injected.

The eye, of course, when you have withdrawn 1-1/2 cc. of vitreous, has pretty much collapsed, like a puckered grape. It restores, of course, quickly, and normally with the injection.

The needle is withdrawn quickly while the assistant keeps traction on the sutures, so that the wound closes when the needle is withdrawn.

I have had some trouble with sutures pulling out on some of them. In that case, I have had to grasp both edges of the wound quickly with the forceps while other sutures were placed. That hasn't made any bad effect at all, but the placing of the sutures is a great help.

The postoperative treatment is purely empirical. I have kept the patients in bed for a number of days, more or less as if they were a cataract patient, given them a pillow and some I have kept in for four days, and others I let up at the end of two days. There is no postoperative discomfort, and the patient has no trouble at all. He wants to get out of bed as soon as he can.

I am going to report three cases here, though I have done some others. I might give you a short summary of these three cases. Two of them were successful and one was entirely unsuccessful.

The first patient was a colored man who gave a history of "spots" before his left eye with recurrent visual loss over a period of two years. He wasn't too bright. He was in the Air Corps. (Laughter) He got along well, too. On June 9, 1944, while taking physical training, he noticed some loss of vision in his left eye. This was at not very far from our place, and Major Howe sent him over to us after ten days. He was sent on the nineteenth.

On examination, his right eye was normal and his left eye was normal externally, and the fundus showed a completely blank reflection. A slit lamp examination showed a normal anterior chamber and lens, and the vitreous filled with a number of brown particles suggestive of hemorrhage. Vision: light perception; projection excellent.

At that time, I had not planned on doing anything to him. We surveyed him and, aside from syphilis, which we were not surprised to find, there was nothing else. We sent the patient back to duty on the ninth of September.

We got him back in again on the 6th of January. He had not noticed any change subjectively in that time, and his eye examination was also unchanged. The tension in each eye was 18.

We decided he was a suitable subject for vitreous transplant, and we told him about the procedure and asked him if he wanted to take the chance, and he "allowed as how he would."

We had a donor who was wounded on the 30th of June 1944 by a shell fire, and the eye had a tension of 3/, faulty light projection. The other eye was normal. He had staphyloma over the lower three-fifths. He was the person who was selected as the donor.

I might say that our diagnosis on this colored fellow was spontaneous vitreous hemorrhage and his blood type was O. The blood type of the donor was A.

We operated on the 19th of February. We did it under sodium pentothal and did it according to the procedure which I described. The vitreous withdrawn from this Negro's eye was straw-colored and quite watery. I withdrew approximately 2 cc. and then I replaced that vitreous with the same amount from the donor, put some atropine in his eye and a binocular dressing, and let him stay in bed. He was not a particularly good patient and didn't stay quiet, but he stayed in bed. He stayed, lying down.

I dressed his eye on the third day. There was very little reaction, very slight redness, certainly less than you would expect from an iridectomy.

On the 25th of February (he was operated on the 19th), we looked in his eye and noticed that the vitreous showed considerable clearing and that the disc could now be seen indistinctly. We could also see the diathermy punctures in the periphery. His vision had improved to hand movement at two feet.

On the 27th of February, we found the details of the fundus could be made out in the periphery, well out, extending from nine to three o'clock. There was a small retinal hemorrhage on the temporal side at about 2:30. The disc could not be seen there.

The interesting thing about this fellow is that the injection of this vitreous seemed to have a very beneficial effect on the post-absorbing of some of the other hemorrhages, because the vitreous showed a gradual clearing.

That was noted on March 2. The tension of his right eye was 15; the left eye was 11. Fundus unchanged.

On March 7, it was noted that the vitreous was clearing and apparently the freshly injected vitreous was diluting some of the opaque vitreous and the macular area was visible and there was a small reddish spot in the center which did not look like fresh hemorrhage. It looked like an old macular lesion or an atrophic rather than inflammatory type of thing.

On March 21, the tension was 19 in the right eye and 14 in the left. Vitreous remained clear.

On May 3 (that would be possibly about six weeks), the vision of the left eye was 20/100, with -1.00 axis 180, 20/60-1. Tension 17 in each eye.

That I considered as an indication that his eye had returned more or less to a normal state, which was after about the first eight or nine days, white, and there didn't seem to be any difference of appearance between the two eyes at all.

He was sent back to duty on June 6, at the same air field.

I saw him again on September 28. At that time, the tension was 17 in each eye, both eyes white and quiet. Ophthalmoscopic examination of the left eye showed some floaters but not more than on the previous examination. Disc, vessels and macular area were distinct. Periphery was clear except below where some old vitreous hemorrhage was still present. Vision was 20/100, and corrected with -1.00 axis 180 20/60-1.

Judging by the appearance of the vitreous and the appearance of his macula, I felt that his vision would have been better if his macula had been in better condition.

I haven't seen this man since, but there has not been any change from February 19 to September 28. I don't think there is anything further to comment on that particular case.

The second case was blood type O, a boy twenty-three, who was involved in a fight on December 25, 1944, and was struck on the left eye and lost consciousness. Examination at overseas hospital on December 29, 1944, revealed vision: Right eye 20/20; Left eye - light perception with proptosis and hemorrhage into the anterior chamber. Tension was elevated. While he was under treatment, hemorrhage of the anterior chamber absorbed revealing a remaining hemorrhage in the vitreous. Patient was examined by me on February 17, 1945.

At that time, the vitreous was normal. The left eye showed black reflex, and there was a large amount of mobile blood pigment in the vitreous. It was very dense. Vision was light perception. Tension 15 and 16. No foreign body.

There was appearance of a slight amount of hemorrhage which might have been fairly recent in the extreme periphery below. That was noted on the 8th of March.

For some reason or other, the notes on this man do not contain reference to light projection, but I feel that the projection was probably normal because it was something I paid attention to.

We decided to do a transplant on him. Our donor eye was type O. That is the same as the recipient. He had been hit with a B-B shot at the age of nine and later lost the sight of his eye. At the time of the examination the cornea in his left eye was thick and somewhat opaque. Anterior chamber very shallow with dense pupillary membrane. Tactile tension - normal. Vision: Right eye 20/20; left eye - light perception, faulty projection.

That man was operated on. We put one in one operating room and the other in another. We operated on March 9, and I went through the usual procedure, but I could not withdraw vitreous through the needle. Something seemed to plug up the needle. I think my reaction is that

the retina and possibly the choroid plugged it up, because when we took the needle out we lost quite a good amount of clear vitreous from the eye. I think that he must have had a detachment of the retina from the way it behaved, although I don't know. I did inject 1.5 cc. of clear vitreous, and I think I may have injected it back of either the retina or the choroid, possibly back of the retina. I don't think I got into the vitreous chamber, because it was very dense with hemorrhage and the vitreous that came out was transparent.

That was on March 9. I dressed him on March 12, and we noticed a small amount of fresh hemorrhage on the lower border of the pupil. Tactile tension felt normal. At that time I could see a vessel of the fundus in the temporal side, and it was suggestive of a detachment of the retina.

On March 21, the tension was 17 in the right eye and 20 in the left eye. The vitreous still had this large hemorrhage in it. The vision was hand movements at six feet. The projection was poor on the temporal side. He had also a little tinting of the iris, suggestive of fresh hemorrhage.

The tension remained normal. The iris resumed the normal color. He got no improvement in the eye whatsoever, and he was finally discharged from the hospital on August 26.

The third case was a young white man, age 27, blood type A. This fellow was on our blind program. He stepped on a land mine on August 29, 1944 and was injured in both eyes, legs, right arm and chest. The right eye was enucleated shortly after injury. It was noted at the overseas hospital on September 2 that there was some red blood in the vitreous chamber of the left eye. The patient was examined at Dibble General Hospital on November 17, 1944.

The examination at that time showed ophthalmosteresis in the right eye, and vision in the left eye 20/300 uncorrectible. Small corneal maculae and foreign bodies. Corneal scar at 2 o'clock with some imbedded debris. There was a complete iridectomy in the upper temporal quadrant. Anterior chamber was of normal depth. Iris pattern was well preserved. Pupil reacted to light and there was a slight capsular opacity of the lens posteriorily. Ophthalmoscopic examination showed there was a dense vitreous opacity occupying all but the extreme upper periphery of the fundus.

Wolf, in his "Pathology" speaks about cyst in the vitreous. Other people say you can't have a cyst in the vitreous.

The upper border of this hemorrhage was curved and it seemed to be well outlined. You couldn't see anything below that curve, and above that you could see retinal vessels.

This boy was ready to go to Avon. His home is in New York, near Albany. I told him, "If you want to take a furlough and come back, we will try this procedure on you, if you want to take a chance." He said he did. As a matter of fact, I told him that before I operated on these other two patients, so he took a furlough, and then came back for the operation.

The donor had blood type O. He had penetrating wound of the left eye, lacerations of the lids, marked leucoma of the cornea, with a disorganized lens adhering to it. Vision with hand movements at one foot, projection poor.

This patient was operated on April 12, 1945, and 2 cc. of vitreous was withdrawn through an incision at the temporal side, and a like amount was injected from the donor eye.

Postoperatively, he showed the slight ciliary flush that these others had shown, and nothing more. On April 8, he had a good red reflex visible over the upper one half to two thirds of the fundus and the retinal vessels could be clearly seen in the macular area and on one-half of the disc. The tension was low.

On April 20, the notes are pretty much the same. There was a large vitreous floater which temporarily obscured the vision as the patient moved his eye.

During the following three weeks the eye became entirely white and the tension gradually improved, and the upper half of the fundus became clearly visible.

On May 12 the tension was 12.

On May 31 the tension was 13.

I took him in about the 27th of May to test his vision and he had about 20/400. I thought his eye looked pretty good. I sent him back to the ward and decided I would give up my practice of ophthalmology and do something else.

He came back three days later, and he talked to me. He is a funny fellow. He has caused a lot of trouble. He was always getting into trouble. He said, "I want to tell you something."

I said, "What's the matter?"

He said, "You know, the other day when you examined my eyes, I didn't tell you what my vision really was."

The California sun came right out, and things looked better. I said, "What's the idea?"

He said, "Well, you know, I was afraid I would lose my pension if I told you I could see better."

I said, "You will probably be all right that way. Let's check your vision." So I tested his vision. It was 20/40, and with the -1.00 it was 20/20-2. There was considerable cloudy vitreous in the lower two-fifths of the fundus.

During the ensuing weeks, the fundus details in the upper two-thirds became quite clearly visible up to the periphery and opacity tended to settle down. I was bothered by these opacities that were tending to float past his vision if he moved his eye quickly.

However, he read his mail and wrote letters home, but he didn't feel he could drive a car. As a matter of fact, he went around with a WAC and finally married her.

We discharged him from the hospital on August 6. His tension was normal. Vision: 20/40 with -0.50 -0.50 axis 155 = 20/20.

His visual field was good except for the opacity in the periphery below.

Not included in this report, I have done a total of nine patients, and I haven't lost any eyes. The blood types apparently made no difference. In some the vitreous appeared to be more fluid than in others. In some it apparently does not give the appearance of being unusually fluid.

Of these nine, four are 100 per cent successful, in my opinion; four are improved; and the one that I report here is entirely unsuccessful.

Some of the cases that are improved were cases that had a dense, almost a clot possibly, a hemorrhagic right eye vitreous in the center, and when we tried to get it out we could see it plug up the needle so it wouldn't come out, and all we have been able to do is to dislodge it and then wait to see if we could get some further improvement in the vision.

I think that we have been inclined to treat the vitreous with a great deal of respect possibly, more than we need to. I don't know. Certainly I think that the loss of vitreous which one might have with the cataract operation and consider as somewhat a serious complication is a hangover from the days when extra-capsular extractions were done. I know it was the opinion of many men that loss of vitreous in intracapsular operations is not necessarily a serious complication at all. Certainly in operations

for the detachment of the retina, we reduce the vitreous volume a great deal.

The following are my observations on these cases:

From 1.5 to 2 cc. is the maximum amount of vitreous that can be withdrawn through the size needles that are used.

The blood type is not significant.

There was a decided reduction in the vitreous opacity in all except the one entirely unsuccessful case, and I think that was because we didn't get enough.

The pathological vitreous in some cases appeared to be more fluid and in some cases the transplanted vitreous appeared to be more fluid than normal.

There was a very moderate reaction following this procedure but no evidence of foreign protein reaction was noted.

The tension in all three cases returned to normal within a reasonable period of time and remained normal.

I feel that this procedure holds possibilities in vitreous hemorrhage, and it may be that the time to do it is possibly within a couple of weeks after a severe vitreous hemorrhage, when the severity can be evaluated, rather than waiting until that hemorrhage becomes organized or until the retinitis proliferans have formed.

It may be that some of these eyes which have gone on to degeneration might be healed. Certainly a rupture in the choroid is not necessarily a reason for the loss of the eye. We have all seen eyes that have had ruptures in the choroid.

The other situation in which I think that this procedure may have value is in operations for detachment of the retina. It has been observed by a number of people that in some cases there is adhesion of the vitreous or shrinkage of the vitreous and adhesion to the retina which causes the retina to tear and pull off. Certainly any operation we do nowfor detachment of the retina reduces the volume of the vitreous. It may be that the tear is a symptom of the detachment and not a cause.

I might say that while you treat the hole and you can cure the detachment, you may not be treating just the hole. You may be treating the adhesions. Either directly or indirectly, you may be creating a stronger adhesion opposite the point at which your adhesion is present. Certainly the recurrence of the retinal detachment indicates that you haven't eliminated the cause.

I did treat one case of detachment of the retina, that I was not going to report at this time because it is only one case, and one swallow doesn't make the spring, and so on. We are planning on operating on some cases of detachment of the retina, but probably this question will come up, and I may as well tell you what we have done at this point, just for what it is worth.

I cannot give you the exact data on this patient because I didn't plan on including it, and it has been about two and one-half months since we operated on him.

He had spontaneous detachment overseas and was operated on twice there. He was operated on once at our place, and all three operations were unsuccessful.

The retina was, I guess, approximately two-thirds off; however, the tension remained normal and so we decided that we would operate on him.

By the time we got hold of a fellow who had some good vitreous, the rest of his retina came off, and while there was a piece, just a little narrow strip I suppose, maybe five per cent of it was on one quadrant. We went ahead and made a couple of rows of diathermy punctures around one-half of his globe. We didn't see a hole and we didn't look for a hole. We didn't treat any hole. In fact, we are not very good at finding holes. Although we are pretty close to Pischel, the influence doesn't seem to benefit us. We made most of these diathermy holes deep and through the sclera. We were able, fortunately, to get a tight closure around the needle, and injected this vitreous in there. This fluid of the retina came out like water through a sieve. In fact, it blew the tension of that eye up to about 30 or 40 with the needle in there. It was not anywhere near that high when we took the needle out. As a matter of fact, there was a small opacity floater in the vitreous I had taken out of the fellow's eye. I wasn't intending to inject it, but got interested or excited or something, and injected the opacity too. We closed it up, and the retina went back in place, and it is all back in place today.

What that means I don't know, but I feel that we are just on the edge, and that is about all I have to say about it. Thank you. (Applause)

DISCUSSION

DR. JOHN KEYES (Inactive): I would like to ask the colonel a question. Would he care to comment on normal vitreous from an anthrapoid, such as the chimpanzee, as a possible source of vitreous for transplanting?

LT. COL. CUTLER: I forgot to mention some heterotransplants that Air Commodore Livingston made. I don't know whether Air Commodore Livingston came through your place or not. He is head of the Ophthalmological Section of the Royal Air Force. He was quite an entertaining gentleman. When he was out at our hospital, he said he was interested in this. "As a matter of fact," he said, "I was interested in that myself a number of years ago."

I said, "I remember now." I looked up this thing I had written up, and here I had a note about that time that he was boot captain or something else in the Air Corps, and he had done some pure transplants from dogs and pigs and goats or something like that, and only one was successful. He didn't do many, about six.

He said that he felt that the heterotransplant (I think it was in the dog and I have forgotten what the other animal was) seemed to be all right. Transplants have been done from rabbits to human eyes without success. No one has done anything about the anthrapoids.

I have felt that as far as the source of supply is concerned, vitreous should be reasonably easy to get if we need it, and I have a feeling that it should be possible to keep it. Surely there wouldn't be any objection to getting vitreous from a freshly deceased person. It certainly should be a lot easier to get than cornea, for instance.

With the exception of this one, observation of Livingston, heterotransplants have not been successful. I think it is something to look into yet.

LT. COL. BURCH: Do you feel that this procedure would be contra-indicated in the case of arteriosclerosis, hypertension, diabetes, or some of the things that are apt to produce vitreous hemorrhage?

LT. COL. CUTLER: The only thing I can say is that where there has been retinal hemorrhage, as there was in this colored fellow, whatever the cause was, he had a spontaneous hemmorhage in the first place. It certainly has not had any ill effect on that condition. We have had a case or two of Eales' disease, and I am anxious to have a patient to do a transplant on him.

I believe that vitreous is a nonspecific protein as far as human beings are concerned, as far as my observation goes, and I don't know what the answer is to that question, but I wouldn't think it would be contra-indicated.

... Major George A. Filmer, Beaumont General Hospital, read three papers:

"An Alternate Method of Eyelash Transplant"

"Myositis of Extraocular Muscles Causing Unilateral Exophthalmos"

"Relaxation Deformities of the Eyelids and Socket Following Enucleation"

AN ALTERNATE METHOD OF EYELASH TRANSPLANT

Although a variety of methods of replacing eyelashes have been suggested and employed, the one which is most readily handled is free transplant of cilia-bearing skin from the eyebrow. The usual location of donor site in this transplant is the inferior border of the nasal end of the brow. Here, in most individuals, the cilia are directed largely upwards as well as slightly laterally. Thus, when transplanted to the new location in the lid margin, the graft can be placed so that the cilia are directed to curve upwards in the upper eyelid and downward in the lower, corresponding to the direction of the normal lashes.

In some individuals, it is not practical to take the graft from this location for any one of several reasons. Many normal persons do not have the upward growth of cilia at the nasal end, all cilia maintaining a temporal direction throughout the entire length of the brow. In other cases, the inner end of the brow may be involved in scarring from healed wounds, or perhaps may have been used for previous lash transplants. In these cases, an alternate donor site for the graft has been found practical.

In this method, a vertical segment of the eyebrow is taken from almost anywhere along its course. Frequently the brow widens near the outer end and allows a longer segment to be obtained. The course of the cilia is directed temporally in the brow, and it is only necessary to rotate the segment 90 degrees either way, depending on whether it is to be used in the upper or lower lid. This method is most practical where relatively shorter areas in the lid margin have to be filled in, but two or more segments can be taken and placed end to end if necessary.

The recipient site is prepared in the usual manner, a trough being made in the lash line of the lid. Then a site is selected along the course of the eyebrow where the growth of cilia is sufficiently luxurient and a vertical segment removed. This extends the entire width of the brow, is wide enough to include three or four rows of cilia, and is deep enough to include a thin layer of subcutaneous fat. If excessive fat remains on the under surface of the graft, it may be trimmed off until the black dots of the hair follicles are just visible, care being taken not to injure the follicles. When making the parallel incisions for the segment, the ends are converged to form points so that closure of the wound is facilitated. The brow

wound is closed carefully to insure a hairline scar.

The ends of the graft are trimmed off enough to allow it to fit accurately into the trough in the lash line, and the segment is sutured into its bed. Atraumatic sutures are preferred; as few as possible should be employed, and with as little trauma to the graft as possible. The sutures are removed on the fifth day.

Frequently all the cilia in the graft fall out following the surgical procedure, and commonly the marginal rows do not regenerate. The more central row or rows, however, begin to grow out again after a month or so if the transplant is successful. These new cilia sometimes grow out longer than the normal lashes and it is necessary to trim them periodically. The scar in the eyebrow gradually fades, and is almost indistinguishable after a few months.

MYOSITIS OF EXTRAOCULAR MUSCLES CAUSING UNILATERAL EXOPHTHALMOS

The problem of unilateral exophthalmos always challenges the diagnostic prowess of the ophthalmologist, and on frequent occasions, even after exhaustive clinical and laboratory investigation, the basic etiology eludes discovery. In the present discussion, two cases are reported. In the first, pathologic examination of biopsied tissue established the diagnosis as granulomatous inflammation of extraocular muscle. The second case manifested certain points of similarity with the first, but no definite diagnosis was made.

1. The first patient (J.S.), a 24-year-old soldier, had been in good health prior to the onset of his eye condition. He had had diphtheria at the age of four years without complication or sequelae. His father had mild diabetes, but otherwise there was no history of significant familial disease. He had been a machinist in civilian life, and worked as an airplane mechanic in the military service.

On the morning of 25 June 1945, he awakened with a headache over the entire right side of his head from the frontal to the occipital region. He received some relief by taking aspirin; but three days later the ache became localized above and behind the right eye and he began seeing double. During the next week, he developed a sense of pressure behind the eye, noted prominence of the eye and swelling of the eyelids, and became photophobic. He kept the eye shut to avoid light and diplopia. He was admitted to his station hospital on 10 July 1945, and shortly thereafter was transferred to an AAF regional hospital where further clinical examination and X-ray studies failed to reveal any cause for the condition. Although no real evidence of inflammatory reaction was noted, he was given penicillin as an empirical measure, but without effect. He was transferred to William Beaumont General Hospital on 21 July 1945.

On admission, the patient still complained of severe right frontal headache, only partially relieved by aspirin and codein, and of constant diplopia in all directions of gaze. Physical examination was normal with the exception of the region of the right eye. There was slight redness and swelling of the upper and lower eyelids and moderate ptosis of the upper lid, with apparent slight paresis of the levator muscle. The eye was proptosed approximately 6 mm. as compared with the left, and there was moderate congestion of the conjunctival blood vessels. Extraocular motions were markedly limited in all directions, external rotation being somewhat better than other motions. The cornea was clear and there was no slit lamp evidence of intraocular inflammation. The pupil was equal in size to the left, was regular, and reacted promptly to light and accommodation. The vitreous was clear and the fundus appeared normal with the exception of questionable slight fulness of the retinal veins. The disc appeared of normal color and was well outlined. Vision was 20/20 in each eye, and the visual fields were full and normal. Color vision was normal.

The blood, Kahn and urine were normal. White blood cells were elevated to 13,300 with 72% neutrophiles, 22% lymphocytes, 5% monocytes, and 1% eosinophiles, but a later count two weeks later was 9,500. The red blood cell count and hemoglobin were within normal limits. At no time was the body temperature elevated above the normal level.

Clinical examination of the nose and throat was normal, and X-rays of the para-nasal sinuses indicated no pathology. X-rays of the skull and orbit were normal, and special laminagraphic studies of the right orbit revealed no bony or soft tissue abnormality. Chest X-ray was reported as essentially negative, although a group of calcifications in the right hilar region was noted. The pulmonary consultant attached no practical significance to these calcifications and gave clearance for any chest pathology. Skin patch tests to tuberculin in dilutions of 1:100,000 and 1:10,000 were negative. A BMR was calculated as +11%, within normal limits. General neurologic examination revealed no significant findings.

On 30 July 1945, during the course of the clinical and laboratory investigations, the patient noted that the vision in the affected eye had become blurred for the first time. Ophthalmoscopic examination revealed no change from that on admission, the fundus appearing essentially within normal limits, but the vision had decreased to 20/200. Peripheral fields were full, but tangent-screen examination revealed the central scotoma and loss of red-green perception characteristic of retrobulbar neuritis. He was placed on high doses of thiamin.

Since no etiology had been established and since there had been no spontaneous improvement in the condition, it was decided to surgically explore the orbit. This was accomplished on 7 August 1945. Under general anesthesia of sodium pentothal, an incision was made over almost the entire length of the inferior orbital margin and the orbit was entered. The orbital fat appeared grossly normal, but a portion was removed for biopsy to rule out changes found in pseudo-tumor. The orbit was probed with a blunt metal probe without encountering any particular resistance, but on insertion of the little finger as far as possible, a small mass was found inferior to the globe. On investigation, this proved to be the inferior oblique muscle, which was enlarged and thickened in its entire extent from origin to insertion, and had a rubbery consistency. The entire muscle was excised for biopsy.

The pathologist reported the orbital fat as normal. The muscle was reported as firm and delicately encapsulated, with a longitudinal groove present along one surface. Cut surface revealed a pale grayish-white relatively homogenious central portion, with an imperfectly demarcated peripheral rim of deeper tan color. Within the central portion there were a few very faint white streaks, but the specimen did not resemble muscle tissue in the gross. Microscopic examination revealed striated muscle fibers, largely replaced by a granulomatous inflammatory reaction. Central areas of necrosis were bordered by a rim of radially arranged epithelioid cells. Numerous small discrete granulomata within the central necrosis showed multinucleated giant cells and the appearance of tubercles, with extensive lymphocytic infiltration. Acid-fast stains failed to reveal the presence of bacterial organisms. A pathologic diagnosis of granulomatous inflammation, probably tuberculous, of inferior oblique muscle, was made.

On recovery from the general anesthetic following the operation, the patient stated that his headache had been relieved. A mild pressure dressing was left on, and was first changed on the fourth post-operative day. At that time, it was noted that the proptosis had receded somewhat, but there was a complete paralytic ptosis of the upper eyelid, and the eyeball was almost completely fixed except for slight external rotation. During the following two weeks, there was marked improvement from every standpoint. The proptosis completely receded, the levator muscle completely recovered its action, and the function of the other extraocular muscles improved. Vision improved to 20/50, with a residual relative central scotoma. On 9 September, it was thought advisable to allow the patient to go on furlough pending further observation.

One month later, on 9 October, he returned from furlough with only few residual findings. There was paresis of the superior and medial recti, but other ocular motions were full. Vision had improved to 20/30-2, and a slight pallor of the papillo-macular bundle area of the optic disc was becoming apparent. There was diplopia in the primary position and to the left, but single vision could be obtained on looking to the right.

Because of the diplopia, the patient was discharged from the Army on 1 November 1945, with the expectation that further gradual improvement would take place.

2. The second patient (W.M.), a 25-year-old white soldier, was stationed in India and had been in good health prior to the onset of his illness. On 11 July 1945, he awoke in the morning with a severe left frontal headache, and was conscious of blurring of vision and spots before the left eye. He reported on sick call, where the medical officer noted a proptosis of the left eye. The proptosis was measured as about 9 mm. as compared to the right eye, and congestion of the conjunctival vessels was noted. The fundus was normal except for fulness of the retinal veins. Vision was recorded as 20/70, and the visual fields were reported as normal. General physical examination was normal, as were the blood counts and urinalysis. The blood Kahn was negative. Blood smears for malaria and relapsing fever were negative. Stools were negative for ova and parasites, and skin tests for trichiniasis were negative. X-rays of the orbit, para-nasal sinuses, and chest were normal.

During the few days following admission to the hospital, the the vision became more blurred, and was finally reduced to light perception. On the seventh day of the disease, the patient developed a fever of 102°, following which the headache and pain in the eye were largely relieved, and one week later enlargement of the pre-auricular gland was noted. On the tenth day of the disease, it was apparent that the external rectus muscle was almost completely paralyzed. On the 24th day, 400,000 units of penicillin were given, followed in the next few days by recession of the proptosis, improvement in vision, and improvement in function of the external rectus.

He was returned to the United States, arriving at William Beaumont General Hospital on 4 November 1945. By this time, all signs and symptoms had cleared up except a slight residual paresis of the external rectus with diplopia on looking to the extreme left. Vision had improved to 20/20 with correction of a minor amount of astigmatism.

The first case was proven by biopsy to have a myositis of the inferior oblique muscle, and by inference from the clinical findings, one can assume a similar affection of other muscles within the orbit. Apparently the orbital fat was not involved, as indicated by biopsy of this tissue, but the optic nerve suffered an associated inflammatory reaction. Why the process should subside following surgical exploration of the orbit is a matter for speculation. The second case cannot be labeled with a definite etiologic diagnosis, but bears a number of points of similarity with the first. The proptosis, optic neuritis, and paresis of extra-ocular muscle, with eventual recovery or improvement, were common to both. However, the second showed evidence

of an acute inflammatory process, with apparent favorable response to penicillin therapy. It is possible that this may fall within the group of cases given the diagnosis of pseudo-tumor.

RELAXATION DEFORMITIES OF THE EYELIDS AND SOCKET FOLLOWING ENUCLEATION

Deformities of the eyelids following enucleation are commonly of the cicatricial variety, resulting from wounds which also injured the eye and necessitated its removal. These are corrected by skin graft, pedicle flap, "Z" plasty, or other appropriate procedure, and it will not be within the province of this paper to discuss these.

Following simple enucleation of the eye, where no injury to the eyelids has occured, it is occasionally found that cosmetic deformity of the upper or lower lid is present after the prosthesis has been fitted. This may be due to relaxation, retraction, or atrophy of the lid tissues. There may be ptosis or recession of the upper lid, excessive deepness of the upper fornix, shallowness of the lower fornix, sagging of the lower lid, or a subluxation of the entire socket and eyelids. Consideration of corrective measures for these conditions will be discussed.

A mild ptosis of the upper eyelid is occasionally encountered which cannot be satisfactorily corrected by enlarging or modifying the prosthesis. Unusually very little elevation of the lid is necessary to adjust it to the level of that of the other eye, and this can be accomplished by such procedures as the Blascovicz or Everbusch operations. The Hildreth modification of the Everbusch operation has proven very satisfactory, as it effectively shortens the levator muscle any desired amount, and the amount of shortening can be readily controlled.

Recession of the upper lid immediately beneath the brow is a rather unsightly deformity, particularly after some time has elapsed following the enucleation. This is apparently due to atrophy of fatty tissue in the anterior superior orbit, but filling this out with transplanted fatty tissue from the abdominal wall or elsewhere is usually unsuccessful due to further atrophy of the transplanted fat. The use of fascia lata and muscle tissue have also been advocated, but a relatively simple and satisfactory method is a dermal graft from the abdominal wall. This fills out the depression without interfering with the action of the lid. The graft decreases 10 to 20% in bulk in a few months, and occasionally develops sebaceous cysts.

Atrophy of the anterior superior orbital tissue may also result in excessive deepness of the superior fornix of the socket. This is of no consequence in itself, but may produce a secondary effect on the lower eyelid through the prosthesis. A prosthesis made to fit this type of socket of necessity has a large backward extension on its

upper portion, and the pressure of the superior tissues of the upper fornix on this extension may force the lower lid downward. If this effect is slight, a simple external canthal tarsorrhaphy may suffice. However, it is usually more satisfactory to correct the basic cause and fill in the deep upper fornix. This is accomplished by incising the conjunctiva just above the upper border of the tarsus, dissecting the conjunctiva from the entire upper fornix, and filling in the deeper fornix tissues with mattress sutures of catgut. By this procedure, the heavy upper extension on the prosthesis is eliminated, and the downward pressure on the lower fornix and lid is relieved.

Relaxation and sagging of the lower lid is rather commonly encountered, and the corrective measure employed is determined by the degree of sagging. The simplest treatment for mild to moderate amounts is external canthal tarsorrphaphy. Any technic which spares the lashes is to be preferred, since the cosmetic effect of shortening of the palpebral aperture is largely avoided. The sutures are left in for one week, and the prosthesis is left in for another week if possible to prevent tearing of the tarsorrhaphy adhesion.

If the amount of sagging of the lower lid is too great to be corrected by canthal tarsorrhaphy, the Szymanowski or Kuhnt-Szymanowski procedures may be satisfactorily employed to add tension to the lid tissues. In any case of relaxed lower lid, there may also be an accompanying situation of excessive shallowness of the lower fornix. In these cases, the addition of two Snellen type sutures in the depths of the lower fornix is usually effective. These sutures may be of dermal, double-arm, and tied over small buttons on the cheek. The sutures are tightened a little every day and finally removed in about a week. The scar tissue formed along the tracts of the sutures deepen the lower fornix and allow the prosthesis to be retained.

If the sagging of the lower lid is extreme, none of these procedures may be effective in raising the lid and adding tension. Inthis case, a transplant of a strip of fascia lata into the lower lid near the margin is used. The strip of fascia is obtained in the usual manner from the lateral side of the thigh, and should be at least six inches long and about 3/8 to 1/4 inch wide. One end is sutured to the periosteum of the inner end of the inferior orbital margin, the strip is passed along the lower lid margin beneath the skin, around the outer canthus, and upward to where the other end is sutured to the temporal fascia. The lower end should be attached inferior to the course of the lower lacrimal canaliculus to avoid interference with lacrimal drainage.

Finally, there are a few cases where the entire socket and lids are luxated downward to a level noticeably lower than the other eye. Mild degrees of this are not objectionable, as many normal individuals show a measurable difference in the levels of

the two eyes. If the socket is low enough to warrant corrective measures, building up the floor of the orbit by implantation of a layer of cartilage through an incision in the lower lid may be performed. This provides a higher support for the lower fornix and elevates the prosthesis to the desired new level.

The new acrylic prosthesis has aided greatly in minimizing many of these deformities because, unlike glass, it can be modified after it has been made. A clever technician can build up the upper portion to elevate a ptosis somewhat, or can thin it out generally to relieve downward pressure by weight on a lower lid. However, if a cosmetic deformity still persists after maximum adjustment of the prosthesis, then the previously discussed surgical measures may be undertaken.

... Applause ...

... No discussion on Major Filmer's presentations ...

SYMPOSIUM ON INTRA-OCULAR FOREIGN BODIES

REMOVAL OF INTRA-OCULAR FOREIGN BODIES

LT. COL. RIWCHUN (Walter Reed General Hospital): Mr. Chairman, Members and Guests: In view of the excellent presentations that have preceded on this program, up to now, it is with considerable humility and timidity that I present the following.

The foreign bodies that were seen at Walter Reed were in the main metallic, magnetic and so on. In some cases, actual siderosis had occurred. I might add that in the pre-operative technique in preparation, we always made sure that the patient has had tetanus toxoid. If he hasn't had an injection of toxoid in six months, he is given another cubic centimeter.

We were using sulfa, starting 24 hours prior to surgery, but we switched to penicillin when penicillin became quite available. We are fortunate that at Reed, we have the new work of Cabinal Mansy in using penicillin, and a mixture of oil and beeswax, and we can give one injection a day, starting twelve hours prior to surgery. We give one injection which has 100,000 units, and give injection the next day, and if there is any post-operative inflammation or suspicion of any infection, we continue the penicillin until there is no sign of infection.

We give them sodium amytal, three grains, two hours prior to surgery.

The method which we are going to talk about is the pars plana approach, which was originally described by Verheoff, and which he used

initially back in 1935 I believe. In 1941, Barr and Fralich, at Ann Arbor, refined the technique by using a trephine opening instead of incision, through the pars plana.

... Showing of a motion picture film during which Lt. Col. Riwchun made the following remarks:

You place an episceral suture.

As a rule, when the hand magnet is applied, the foreign body will come right through without having to incise it, but in this case that we report here we couldn't get it without incising, and then we had to use a giant magnet because the hand method wouldn't touch it.

In the closure, this can be closed separately, or if the incision is 12 millimeters away, the conjunctiva can be closed at that area.

We use the Van Lint Akinesia. The O'Brien can be used for those who like the O'Brien. Then the Atkinson injection, 2.5 cc. The traction suture is put in.

I won't say anything about the Berman locator because I understand there is a paper on that this afternoon, but Colonel Carney from Boston has been telling me about a locator that he has, which I think I should like very much to have him say a few words about.

We first mark the trephine area and then put in the episcleral suture on either side of where your hinged flap is going to be.

LT. COL. RANDOLPH: Is that an automatic trephine?

LT. COL. RIWCHUN: That is electric, operated by hand batteries. Then we finish the trephine. You can go in at an angle to leave a flap so you can fold it over in this manner. This shows your uveal tissues in the pars plana area.

Ordinarily, most foreign bodies at this point will come right out when you apply the hand magnet. Just because we wanted it to in this case, it wouldn't. So we made a meridonal incision and then followed with the giant magnet.

We inject penicillin, 500 units per cubic centimeter sub-conjunctivally in the region of the incision. The remarkable thing about these eyes is to see the reaction the next day. There is practically none.

I have a film on retinal detachment that was hooked on here. Rather than take if off, I thought we would run through it.

... Showing of film on retinal detachment ...

We have used the six-point electrode not for penetration, for surface coagulation, and we laid down a barrage outlining area of the detachment.

We are using Walker pins here to wall off a hole. We always like to use the Walker pin where there is a hole.

In addition to that, we use the multiple single puncture, and in this case there was quite a billowing with a lot of fluid.

Recently we have been using rubber suction over these holes to suck out as much of the subretinal fluid as we can. You have to be careful with it because it can produce a lot of pressure.

The advantage of the pars plana method of removal is that there is very little danger of hemorrhage. There is practically no danger of sympathetic ophthalmia, and practically no danger of retinal detachment, because, as you recall, your retina is firmly attached at the ora serrata and at the disc. It is the only two points it is attached, and by using this method, where it is applicable, we feel it is the ideal approach for removal of the foreign body. Thank you. (Applause)

... Major H. G. Scheie, Crile General Hospital, read his paper on "Oxygen Injection of Tenon's Capsule as an Aid in Localization of Intra-ocular Metallic Foreign Bodies." (Applause)

Major Scheie's paper was illustrated by a moving picture, showing the technique in detail. He advocates the injection of oxygen into Tenon's capsule followed by radiographic studies of the orbits. The oxygen ring thus demonstrated above the globe is especially valuable in ruling borderline metallic fragments in or out of the globe.

This paper has been submitted for publication and will be available for thorough study at an early date.

In the absence of Major Albert J. Abbott, Valley Forge General Hospital, Captain John S. McGavic read the paper prepared by Major Abbott on "The Use of the Berman Locator in the Evaluation of Intra-ocular Foreign Bodies," and demonstrated the Berman locator.

THE USE OF THE BERMAN LOCATOR IN THE EVALUATION OF INTRA-OCULAR FOREIGN BODIES

A review of the recent literature pertaining to the various problems encountered in the diagnosis and treatment of intra-ocular foreign bodies reveals that the subject is in a remarkable state of confusion. Any globe which has sustained a penetrating wound with a retained foreign body is seriously injured and the ultimate outcome is in doubt. The prognosis is grave but not necessarily hopeless, and, unless the eye has been hopelessly traumatized at the time of injury, it should be considered a potentially sighted eye.

The cases that have been seen at the Valley Forge General Hospital have practically all been the so-called War Injuries. They have been seen relatively late and the time interval since the injury has often been weeks or months. Many of the soldiers have either had one eye enucleated or so severely damaged that there was no hope of salvaging any vision in this globe. In a number of instances, a previous attempt has been made to remove a foreign body. Surgical treatment had often been performed in an attempt to save the eye. In many cases, there were multiple penetrating wounds and retained foreign bodies involving the tissues about the globe - lids, forehead, nose, face, conjunctiva, or episclera, as well as one or more intra-ocular fragments.

The locator was devised to locate retained metallic foreign bodies and utilizes the principles of magnetism. (1, 2) It operates in the following manner:

"In a diagnostic rod is placed the equivalent of two transformers - one in the handle and the other at the tip, which is used to search for the foreign body. The primary coils are connected in series to a source of alternating current. Also in series, the secondary coils are connected through an amplifying unit to a voltmeter. When an alternating current is sent through the primary coils, a current is produced in the secondary coils by induction. The instrument has a means of equalizing (balancing out) the voltages in the secondary coils so that the needle of the voltmeter will read approximately zero, since no current flows between them. Now, if the coil in the tip of the rod approaches a magnetic metal (the foreign body), the balance inductance is disturbed and a difference in potential takes place in the secondary circuit, which results in a flow of current. The amount of this current, shown by the deflection of the needle in the voltmeter, varies with the size of the metallic particle and with its distance from the tip. At the greatest point of deflection, therefore, the tip of the locator is immediately over the foreign body. Conversely, as the locator travels away from the foreign body, the deflection of the needle is lessened. One can estimate the depth of a foreign body in addition, if its size and composition are

known, by determining the distance necessary to give the same reading, with the controls unchanged, in approaching a similar piece of metal. The instrument responds best to iron and steel, and less effectively to copper, brass, silver, aluminum, lead and their combination. The differentiation of a non-magnetic foreign body from a magnetic one is easily made when the needle of the voltmeter does not move at all." (3)

The locator gives both a visual response on the dial indicator and an auditory response on the sound attachment when the probe is brought within range of a magnetic foreign body. The large probe is sensitive that it will give a response to an iron particle 1 mm. in diameter at a distance of about 10 mm. The type of intervening tissue is of no importance as there are no known magnetic insulators. The search coil (inductance) in the tip of the probe contains two poles $1\frac{1}{2}$" apart, each a center of sensitivity. (4)

(Show slide - Fig. 5)

Pole A at the distal tip of the probe is the important one in localization. The sensitivity of the probe is greatest when it is parallel to the surface or at a slight angle. (4) The probe when held perpendicular to the surface is less sensitive but more accurate in ability to localize.

The localizer should be set at its highest sensitivity for purposes of detection. This permits the detection of smaller particles at maximum distances.

The instrument for purposes of localization should be set so that the peak response is under 10 on the dial. This may or may not require a reduction of the sensitivity of the instrument.

When two foreign bodies are present, the instrument set at high sensitivity may respond to both of them. However, by cutting down the sensitivity it may be possible to tune the instrument so that it will respond to each foreign body separately.

The final localization at the time of surgery should be determined with the shield removed from the probe and the element covered only by its rubber glove. Contact with the eyeball but without pressure is required. With the instrument accurately adjusted and the probe perpendicular to the eyeball, the peak response will be obtained over the magnetic particle. (The sensitive pole may be considered at the tip). Pressure of any degree on the element may give a false reading and is to be avoided.

The response of the instrument is influence by the following:

1. The character of the foreign body - magnetic, non-magnetic, or weakly magnetic.

2. The size and shape of the foreign body - globular or elongated.

3. The distance between the sensitive pole and the foreign body.

These factors must all be considered in using the locator for the evaluation of the foreign body. Information obtained from the clinical examination and X-ray localization must be weighed in the interpretation of the locator responses.

Procedure:

The lids, forehead and tissues adjacent to the eye are explored first, following which the globe is examined. The ideal situation pertains when there are no foreign bodies in the surrounding tissues to interfere and only one in the globe. If a positive response is obtained over a lid, the point of maximum response is determined and the probe held in that position. The patient is then instructed to rotate his eye. If there is no change in the indicator, one may assume that the foreign body is in the lid or in tissue which does not move when the globe is rotated. A foreign body at the center of rotation of the globe, however, would not alter the signal. The lid is then moved in various directions and alterations in the signal place the metal in the lid.

Magnetic foreign bodies in the conjunctiva or episclera will give positive responses. They will interfere with the study of an intra-ocular foreign body unless one can get beyond their fields of influence. It is wiser to remove these prior to final evaluation of the intra-ocular fragment and removal may be absolutely necessary before an accurate reading is possible.

It is possible to scan well the anterior half of the globe without surgical exposure. The entire exposed surface of the globe is explored. Assume a positive response in the 12 6 meridian inferiorly with eyes in primary position. If the foreign body is in the lid, pulling the lid away from the probe will decrease the response. If this does not alter the response, the patient is instructed to move the eye in various directions. If, on movement of the eye, the response alters, the foreign body is either (1) outside the globe but in tissue which moves on motion of the globe, (2) intra-mural, or (3) intra-ocular.

The foreign body is known to magnetic, else it would not have excited the locator. If the foreign body is far enough anterior, the localization may be satisfactory but should be rechecked at the time of operation. If one cannot get the probe far enough posterior, it will be necessary to wait until better exposure is obtained at the time of surgery.

If X-ray has placed a fragment in the globe and no response is obtained, the particle is either non magnetic or beyond the field of the pole. If the foreign body is known to be anterior and in a position to excite the locator, no response indicates it is non-magnetic. The metal too far posterior will have to wait until surgical exposure is obtained for evaluation.

The foreign bodies located at the most posterior portion of the globe are the most difficult to examine. The probe should be used with the shield removed. A very small foreign body near the optic nerve may escape detection. If a possitive response is obtained, the peak response occurs when the tip of the probe is opposite the fragment. One cannot be certain that the localization is as accurate as in the case of the more anteriorly located metallic fragments.

CONCLUSIONS

1. The Berman Locator will determine whether or not the foreign body is magnetic.

2. When the exposure is such as to permit adequate manipulation of the instrument, localization can be accurately performed.

3. The data obtained by the use of the locator when correlated with the history, clinical findings, X-ray localization and diagnostic application of the magnet, gives the ophthalmologist additional evidence on which to evaluate an intra-ocular foreign body problem.

4. The use of the instrument is simple and rapid and provides a quick means of checking the position of a foreign body after application of the magnet.

5. Foreign bodies located near the posterior pole of the eyeball and themselves less well to the use of the locator than those more anteriorly located.

6. Multiple magnetic fragments in the orbit or in the tissues adjacent to the globe may prevent satisfactory use of the instrument.

Six case reports were given describing the value of this Berman locator. The first case, J. S., age 28, incurred multiple penetrating wounds, involving both eyes, face, and right shoulder, when his tank destroyer was struck by a bazooka shell. The left eye was enucleated the following day. Two small metallic-looking foreign bodies were seen in the superior nasal vitreous anteriorly. There was a questionable foreign body posterior to these two. A foreign body was localized 7 mm. back of the cornea, 4 mm. above the horizontal plane and 8 mm. nasal to the vertical plane. The locator was not available at that time. There was no movement of the visible foreign bodies upon application of the magnet.

Later the locator was used to evaluate the soldier's condition and the number and position of the foreign bodies. In the meantime the eye began to develop early signs of siderosis. Since the visible foreign bodies did not respond to the magnet and did not appear to be bound down, the locator evidence indicated another foreign body, magnetic in character, in the region of the ciliary body. The eye was operated on, and the incision was carried anteriorly towards the ciliary body. There the magnet produced bulging of the ciliary body but no foreign body was obtained. Apparently scar tissue was holding the foreign body and preventing its delivery from the eye. The foreign body was finally grasped with forceps and dissected free.

The proper evaluation of this multiple foreign body problem was dependent on the following: Visible intra-ocular metallic fragments that did not respond to the magnet, clinical evidence of siderosis, X-ray localization and information obtained from the use of the locator.

M. M. M. - age 21.

The soldier was wounded in Luzon by fragments of a high explosive shell. The left eye had been enucleated. X-ray elsewhere had been negative for an intra-ocular foreign body. There were several areas somewhat suggestive in the eye of a foreign body, but not positively identified as such. The locator was positive in the 9:30 meridian, the peak response being about 10 mm. from the limbus. X-ray localization then showed a foreign body 15 mm. back of the cornea, 3 mm. above the horizontal plane and 10 mm. temporal to the vertical plane. Surgery was advised and after exposure of the sclera, the locator was used and the peak response obtained 11 mm. from the limbus in the 9:30 o'clock meridian.

The magnet caused a slight movement of the sclera at one side of the incision. The incision was converted to a "T" over the site of the scleral motion. The magnet again applied and the foreign body on delivery was cloaked in a dense incapsulating band which was severed.

The original incision had been made within a millimeter of the foreign body. The locator in this case was of definite help in selecting the site of the incision.

A. L. F. - age 28

This soldier had a penetrating wound through the cornea, 4.0 mm. from the limbus at 2:30 o'clock, caused from a piece of steel, while chiseling off a bead of welding of a car bumper. Upon examination, a questionable foreign body was seen in the mid vitreous. This damage was to the right eye. The locator was positive over the superior nasal portion of the sclera.

The X-ray placed the foreign body 18 mm. back of the cornea, 2 mm. above the horizontal plane and 8 mm. nasal to the vertical plane.

The foreign body, after a few examinations was lost and the locator was again used and the peak response was found to be in the 4 o'clock meridian about 12 mm. from the limbus. An incision was made over the pars plana and the foreign body immediately delivered upon the use of the magnet.

This case illustrates the use of the locator for repeated localizations and for following a foreign body after application of the magnet.

R. C. - age 36.

Injured when a rifle grenade exploded, injuring the globe on the right side. Vision: No light perception.

The locator was used in this case and it gave positive response over both lids. Over the globe, a peak response could be obtained between 6 and 8 o'clock but the probe could not be moved far enough posterior to be certain of the antero-posterior localization. Under pentothal anesthesia, the sclera was exposed and the locator was used with the shield removed and the tip covered with the sterile rubber jacket. The sensitivity was cut down to tune out the foreign bodies in the lids.

The peak response was obtained 16 mm. from the limbus in the 7:30 meridian. It was definite and sharp. Incision was made in the sclera, the mid point of the incision being over the site of the peak response. The foreign body was readily obtained upon application of the magnet.

In this case, the site for the incision was made entirely on the locator findings.

E.B. Pfc.

Soldier injured when he tripped a mine, in Alsace-Loraine. Multiple penetrating wounds of both eyes. The left eye was enucleated on 4 December 1944. Only counts fingers with the right eye. X-ray localization showed a wire, however, there was no response to the locator.

It was decided that the foreign body was non-magnetic. In this case locator confirmed the opinion that the foreign body was non-magnetic and that an attempted magnet extraction was not indicated.

A.E.S. - age 25

Injured when a land mine exploded in France. The right globe was proptosed and was enucleated. Progressive loss of vision in the left eye.

Siderotic changes occurred later in this case. No foreign bodies could be seen upon ophthalmologic examination. The locator gave a peak response 8 mm. from the limbus between 7 and 8 o'clock when the magnet was applied pre-operatively.

X-ray examination reported one questionable foreign body 15 mm. back of the cornea, 5 mm. below horizontal plane and 10 mm. temporal to the vertical plane, and a second foreign body 6 mm. back of the cornea, 9 mm. below horizontal plane, and 6 mm. nasal to the vertical plane. An incision was made over the pars plana and the foreign body was immediately obtained on application of the magnet.

X-ray following examination following surgery was negative for intra-ocular foreign body and no response was obtained with the locator.

The locator in this case enabled the operator to place the scleral incision with sufficient accuracy to obtain the foreign body.

L.S. - age 28

Injured when a Jap detonator cap exploded. Penetrating wound of the right eye.

The foreign body could be seen in the vitreous. X-ray localization placed it in the globe. The locator gave no response. The magnet when applied did not produce any motion of the fragment nor did the patient experience any subjective sensation.

A magnetic extraction was not indicated.

...Applause...

LT. COL. GILBERT C. STRUBLE, Chief, Eye Surgical Center, Crile General Hospital, read a paper on "Technical Refinements in the Removal of Magnetic Intra-ocular Foreign Bodies from the Posterior Segment of the Eye" which was followed by a motion picture.

This paper, prepared by Lt. Col. Struble and Major L. J. Croll, will be published in a forthcoming issue of the American Journal of Ophthalmology.

Col. Struble described a method of check localization of intra-ocular foreign bodies which he has used since 1942. This method consists of pinching a lead shaving to a black silk suture and sewing this lead plate to the sclera at the point indicated by the X-ray localization. This procedure is carried out at the time of the operative removal of the foreign body. X-ray films in the lateral and P.A. views are now taken with a portable X-ray machine in the operating room. The authors point out that by using rapid developer solution, the films can be returned to the surgery in eight minutes to be read by the surgeon. From a study of the relationship of the foreign body to the lead marker, any necessary correction as to proper localization can be made before the sclera-tomy is done. The authors refer to this as pin-point localization and believe it is especially indicated where the foreign body is imbedded in the retina, choroid or ciliary body to prevent lateral drag and tearing of these structures as would be the case should the surgical removal be attempted from the side instead of directly over the particle.

Col. Struble described some experimental work performed by Major Croll and himself in which metallic foreign bodies were introduced into the eye and their removal attempted from different distances. His presentation was illustrated by a moving picture film showing the method advocated by the authors for the removal of magnetic foreign bodies from inside the globe without penetrating the uvea with the tip of the magnet.

DISCUSSION

MAJOR TRYGVE GUNDERSON (Eye Consultant, Surgeon General's Office): I would just like to say that the Berman Locator has not been issued to very many hospitals in this country, as you doubtless know. Not being issued in this country, of course, it was not issued abroad either. In the North African Mediterranean Theater, this was certainly true. We wanted one very badly. Fortunately, we had Colonel Carney with us, who had a great many gadgets, and he devised one of these locators, that you might call the Carney locator. It is easily made from mine detectors, and I will leave it to him to tell you how he supplied somewhere in the vicinity of 60 or 80 of

these instruments to practically all hospitals there.

In some regards, I feel quite sure that his instrument was superior to this one. It had a greater affinity for non-magnetic foreign bodies and it also had a very special little needle for introduction into the eye, which proved to be very useful.

I would like to hear from Colonel Carney.

LT. COL. H. J. CARNEY (Fort Devens): I am in the Dental Corps and have not read up on my eye work, but I enjoyed Colonel Riwchun's talk on the Berman Locator and also Major Abbott's paper. I will just, in brief, give a little history of the necessity of making an instrument that I thought a fighter could use.

After the Tunisian Campaign, I set out to try to help out the General Surgeon, principally to locate large particles throughout the body. I went with what I could get from the Signal Corps, having been refused several times. I managed to get a worn-out mine detector and converted the search coil into a small paddle about three inches in diameter with a small hole in the center, and proceeded on that assumption to at least locate in conjunction with the X-ray, these foreign bodies that were left in from time to time.

If you are not familiar with the mine detector, it is an 18-inch disc that is traversed across the earth, possibly six or eight inches above the earth, looking for that perpetual enemy that we had over there.

I reduced this paddle or search coil down to a three-inch disc with a handle. It was set into balance. It had earphones that were placed over the head, over the surgeon's head, back up his gown and attached, and thence to the machine. It was traversed over the suspected area of the foreign body. That was generally located by X-ray, and by means of traversing over and back I got the highest maximum of tone and a deflection on the needle, possibly the same, I don't know. This is the first time I ever saw the Berman Locator in action. Maybe it is the same setup. You get the largest tone in one plane. Keeping that same plane, you go at right angles to it - X marks the cross. But that does not give you the third dimension.

So I added a little bit to this by taking two straight cutting needles, skin needles, and got from the Eye Service needle holders. I used the eye needle holders as handles for two needles, with two wires back to the same machine that I called the locator. The first part I called the detector, that gave me the cross. The locator gave me the third dimension, and I would introduce one needle into the wound or into the suspected area where X marks the spot, and in another position tried to strike the foreign body. When I made contact with the foreign body , it would deflect the needle, giving a registration that you have made contact with metal and not with bone.

Removing the eye needle holders, you have two needles in position, and the surgeon goes down on, wherever his position for the anatomy may desire. This is all done in the operating room and it is done in position on the table. The detector has a range of about 4-1/2 inches deep, and you can tune it into whatever you care to, or whatever sound you care to.

There are a few other features in which I think mine is different from the Berman locator, according to the presentations we have had. It is not powered by any 110 volts. It is merely two flashlight batteries and a B battery. They are easily replaced. As you know the only thing the Medical Corps gets from the Signal Corps is two flashlight batteries. We manage to have them service this instrument and produce it with the aid of German and Italian help. They made up some seventy or more instruments. I cannot recall the exact number. I delivered them and showed each platoon in the field hospital, every general hospital and all station hospitals that were doing any surgical work how to use them.

Later on I was sent to another sector. It happened to be an eye center. I did not know much about eye work, but I just looked over the shoulder and said, "Well, they can roll an eye fairly well. Probably I can apply this."

I saw the surgical procedure. I revamped the instrument so that I could formulate an indicator or a coil that was about as big as a fountain pen, not unlike the one I saw presented here, that has action of just a half inch depth. Assuming that I had a diameter of an inch, I worked on a half-inch basis, and with the rolling of the eye, you could get its nearest approach, whatever position it was. If it is in the posterior, I worked on that assumption that you can pick up. I had no interest in that, because I was told that the magnet took the foreign bodies out that were ferrous or magnetic and took them out well. The purpose I worked with principally was for the non-magnetic - that is, copper, aluminum, lead, zinc, B-B balls, whatever you have. It will not take glass, acrylic or wood.

In addition, I revamped the locators into a miniature bronchoscope, that has its outside diameter about the size of a 20-gauge needle. That is so wide that it will return to the locator, but when you have located, on rolling the eye, into the quadrant you think that it is (and I think this location of methylene blue with the diathermy is a good marker) the introduction into that particular quadrant and the approach by physical contact of this instrument that is so powered that it will register on the dial, that you are in contact with that same instrument by the moving of the leverage of the faucet of the holders. You may operate the jaw and grasp the foreign body, and when you do have the grasp on the foreign body, it will also maintain its registration. Thereby with only one insertion of this locator, it will remove the foreign body.

This phase of the work, the reconversion for the eye, was in the last part of the campaign over in Italy and Major Hick more or less played along with it. It wasn't down to perfection, but since then I have fooled around for the various size foreign bodies and got it comparable more or less to the size that I have seen in the diagram as presented in the other room on display.

Thank you. (Applause)

CAPTAIN ALSTON CALLAHAN (Northington General Hospital): We ran a series of 25 cases, using a fiber modification of the contact lens for localization of foreign bodies. In a small series of 25 cases, we felt we located the foreign body more accurately with the contact lens. That is, we do a Sweet and we do the Pfeiffer method, too, on the same case, and when the foreign body was located we would check with the findings and find that the Pfeiffer lens had located it more accurately. Of course, the Pfeiffer lens cannot be used in nerve injuries where there is any ectodermosis, and it is not applicable in cases where there are several intra-ocular foreign bodies, because then you have some markings on the X-ray that you are not able to tell what you are looking at.

One addition that has been made to the technique by our X-ray man has been the use of the two X-ray machines and a right angle holder for the casettes, which allows almost simultaneous exposure of the two films, the lateral and the P.A. view. Naturally, we couldn't get simultaneous exposure because the X-ray would follow the opposite field, but we built the right-hand angle holder so one could set within and we could shoot from above and had a portable X-ray outfit at the side.

Some of the patients are not highly intellectual, and we were afraid they would move their eyes around while the X-ray machine was shifting to the side.

That method of shooting one and bringing the other casette from behind the screen and putting in place and shooting with the portable unit for lateral view, we thought gave us certain superiority over the usual procedure or method of bringing the lateral.

LT. COL. S. A. FOX: We have made several observations in regard to foreign bodies, intra-ocular foreign bodies, in our place. I would like to know whether other men have had similar experiences.

First, we were struck by the fact that despite a large number of intra-ocular foreign bodies, we received (and I suppose other centers have too) relatively, not absolutely, a small number with magnetic. I think the men overseas did an excellent job. They certainly got a large majority of magnetic intra-ocular foreign bodies.

Secondly, we were struck by the fact that the giant magnet was of relatively little use. When we were able to get the foreign body, we got it with the hand method. When we were unable to get it with the hand method, only in a few cases was the giant magnet of any value at all.

The third observation was that the postoperative course of eyes which had had successful removal of the intra-ocular foreign bodies is not too good on the whole. For instance, I think we probably did 80 enucleations in the past year, of which approximately 20, after the successful removal of intra-ocular foreign body, as far as we could tell from the overseas history, completely clearing up of the eye, and yet some time after that there was siderosis.

LT. COL. EDWARD E. BURCH: I might say that your experience with regard to the incidence of nonmagnetic foreign bodies has been very closely paralleled at O'Reilly. We have seen a great many nonmagnetic foreign bodies.

MAJOR GUNDERSON: There are a few other things I would like to say, if I may.

I was very much interested in Major Scheie's oxygen injection and we would certainly like to see the sphereogram. It appeals to me a great deal.

I cannot help but mention a new textbook on "Operative Ophthalmology" by Rudolph Teal, published in Germany during the last year of the war. It was in two volumes. It struck me as being perfectly extraordinary that a nation on the verge of collapse had oculists in the nation who could publish a book under those circumstances. In the Teal surgery communication, Berg has written a long chapter on the extraction of foreign bodies, where he describes his method and all its variations. It is excellent.

One difficulty that I am sure you have all had in taking a P.A. view, is to keep the eye still. He has devised a nice little mirror which sits off at 45 degrees before the good eye, in which the patient fixes the light and where the eye can be kept still during the period of exposure, which as you know with the ordinary field X-ray unit is a matter of seconds rather than split seconds. It becomes very important when you are photographing tiny foreign bodies.

Another thing which he pointed out and which I later had the pleasure of using, was the Mellinger magnet, which some of you may have seen but I am sure many of you have not. It was made in Berne, Switzerland, I think, first devised by Mellinger. It consists of a huge coil of wire, oval shape, about the size of your head, into which the head can fit. The coil of wire is about

as big as your thigh or somewhat smaller. The core remains outside. You vary the amount of strength, first of all, by the intensity of the current, and second, by the size of the core which you use. The smallest cores are tiny things about the size of a pencil which you hold in your hand, and indeed they have points on them which can be actually placed in the anterior chamber. The largest core is possibly four inches in diameter.

When the magnet is in operation it cannot possibly be held in the hand. Therefore, it is fixed on a stand so that it is held in place, in spite of the tremendous current. This is by all odds the strongest magnet I have ever seen. You might say, "What is the use of the strong magnet any way if you are going to take them all out posteriorly?" I think we should be on our guard and not be the last to give up the old, and in my opinion there still are a number of foreign bodies that had best be taken out anteriorly. I had such an individual that came from the 15th Air Corps, which Major Sand of the Minnesota Unit sent to me after he had siderosis. The foreign body has been in six months, lying below the disc about 2 mm., imbedded in the retina. I think it would have been practically impossible to have gotten it out with the posterior route. This came out very easily by the anterior region, with no tear in the retina or no difficulty whatever.

Another type which I think is very well taken out through the anterior route is the free floating one in the vitreous, regardless of how long it has been in the eye.

Another type I think are the ones who have traumatic cataract, where the eye has resumed a quiet phase. I think it is perfectly feasible to take out the cataract first, see the foreign body, and if it is not attached to the retina, I believe it is perfectly reasonable to take that out to the pupil and remove through a lateral corneal incision.

I like Colonel Struble's name, "pinpoint localization." I have searched for such a word for a long time. I think it hits it right on the pinpoint. I believe it is very important.

I think the Comberg method, combined with this sewing on of a small ring or disc, is the most rapid possible, with the exception of the oxygen injection with which I have had no experience, and the most accurate method with which we had any contact.

The question as to whether foreign bodies are emergencies or not has been one which has been discussed for a long time among oculists. I think the general impression was that the intraocular foreign bodies were emergencies. There the tendency to begin with was to get ophthalmologists forward in evacuation hospitals. My own opinion, after seeing catastrophes that have come from this

surgery, forwarded to small hospitals where facilities are bad, where the rush is tremendous and X-ray facilities are not as good, and where evacuation is often done the following day with a single eye bandage, my own feeling is very strongly in accord with Dr Wheeler who I believe once said that there is no such thing as ocular emergency. Of course, that is putting it a little bit strong, but I have come more and more to the belief that intra-ocular foreign bodies had better be considered as non-urgent things in time of war. I believe there is more damage done by their removal by inadequately trained personnel under adverse situations than by the better facilities and better trained people you will find further back.

LT. COL. E. L. SHIFLETT: It looks as if the radiologists in some ways might occasionally get on the spot. I have some suggestions to make and also some constructive criticism.

I personnaly think that any man who is doing surgery on the eye should be familiar with each type of foreign body localization and should be able to do it himself. I rarely find ophthalmologists able to do that. Unless he is going to do that, he is not able to judge whether nor not his assistant is competent.

Let's divide this up in a logical discussion. Let's state, first, the personnel. I am surprised at the number of boys I question, who come back from overseas with foreign bodies in their eyes, at the number who have been examined by technicians, enlisted men technicians. The radiologist does not even supervise it. You can have a well trained technician in the mechanical aspects of this game, but he is not cognizant of the pathology that might influence localization, and as far as I can determine, no men have been interested enough to go in and see that that is being done. That is not the fault of anyone in particular, except the radiologist in charge.

This is my third year in this hospital now. Never has a technician made a localization of the foreign body. We have tried to teach them how to do it so if they got on the battlefield they might be of some help to you men, but not one localization in this hospital has been made from a film made by a technician. It has either been made by myself or by my assistant.

Now Let's divide the method of examination. We have the Sweet, the Comberg, the Pfeiffer, and various other methods. After using the Sweet method for twelve years, I do not think there is anything as accurate, that offers the least chance of personal error on the part of the patient.

I think that the man should use the method with which he is best acquainted, because with that method he will make less errors. None of these methods of triangulation of localization of foreign bodies in a small object like the globe of the eye is satisfactory.

Another thing you have to remember is the fact that you are dealing with abnormal eyes. In civilian life, you are dealing with the normal eye, that has a small fragment in it, that you get one hour or two hours after injury. You do not encounter that in wartime unless you do encounter it at the front. I haven't been over there; I don't know.

The chief difficulty we have with the method at the present time is the lateralization and not the P.A. film. In fact, the P.A. film hardly enters into the accurate localization of the foreign body in the globe. Of course, you depend on the P.A. with the Pfeiffer method, localize it with the quadrant and get at the rest of it.

We investigated the Comberg method. If you will compare the instruction of the Comberg and Sweet, you will find there are a great number of possible errors because of the frequent change in technical factors while you are doing examination. The only difficulty with the Sweet is when the patient is unable to look through infinity. He has not moved during examination. Nothing is moved except your tube, and it offers the least possible chance of error and error on the part of the patient.

There is another thing that I have noticed. I always go over these localizations that come back from overseas. We have had numerous ones here. There is a carelessness with which they are plotted, the dots here and dots there and broad pencil lines here and there, cephalocaudad and caudocephalad shifts, all kinds of technique. Of course, I have checked the cephalocaudad shift. That is what it should be, but to reverse it, I have checked those out because I didn't want to make a nut of myself by criticizing that and I find it doesn't make any difference.

If you are going to localize these bodies accurately, use the grid on localization sheet, plot your points, and forget your lines, because a broad pencil will throw you out two or three millimeters. We have sought for protection here. We do not consider any localization that is off as much as a millimeter worth a dollar. We consider it an error.

The one that Colonel Struble used this afternoon was used to demonstrate to you the value of the pinpoint localization. That represents the farthest error we have made since he has been here, and we can show you those in which they are superimposed. I think it is a wonderful method, and he is to be congratulated on developing it and using it because we realize we make errors on these cases. We can't help it.

I think with the high development of technical skill in some of the laboratories of this country, it might be worthwhile for the radiologists and ophthalmologists to get together and contribute this problem to some of the main technical organizations of this

country and see if they can devise a better method of localization. I think it would be worthwhile. We need something that will emphasize the P.A. rather than the lateral. The lateralization is what gives the trouble.

Now, as to the injection of Tenon's capsule, that emphasizes the necessity of adapting methods to look at problems encountered at the time of injury. It is a good method, provided that you can use it, but all men do not see steresocopically through the millimeter. As Colonel Struble has emphasized, you have to have pinpoint localization.

If you realize how many tangents must be made to a sphere, that anybody that is not on the summit of the sphere in two planes will appear to be in the globe, with air in Tenon's capsule, I think you can appreciate the tremendous job that has to be done and how much greater is the compliment that Major Scheie deserves for what he did overseas. It is merely when you get it outside, and two perpendicular tangents to a given point on a sphere. Otherwise, I wouldn't trust stereoscopic vision. I wouldn't trust myself, and I wouldn't trust you. If anybody went into my good eye, I would get a gun on him if I ever got out of the operating room. That is the way I feel about it.

All those factors have to be taken into consideration in discussing localization. You can get them accurate if you work hard enough and work long enough. It demands the closest cooperation between the radiologist and the ophthalmologist. One must completely forget these little professional jealousies that exist between specialties and work together. If you try to dominate a radiologist you probably won't get any cooperation. If he tries to dominate you, you won't get any cooperation. It is necessary to forget everything except the welfare of the patient, to accept equal responsibility. If anybody says he can't get rid of them,he shouldn't be on the job. (Applause)

LT. COL. RANDOLPH: At Valley Forge, during the early spring months and during the summer, foreign bodies seemed to be at the highest. We were doing, I suppose, about an average of three or four a week, that is, attempting them.

I can certainly say that the giant magnet was successful in only one attempt, and there were plenty of them that we didn't get. In only one case was the giant magnet successful. I understand that previous to February, at which time I came, only one had been done.

We are quite sold on the pars plana approach and consider it, when it is unsuccessful, as a very benign procedure, certainly not more dangerous than a cyclodialysis, provided, of course, you don't go through the choroid.

In those cases where we see a foreign body, particularly imbedded, particularly large, located in the region of the equator or behind, we think there is danger of pulling off the retina with a para plana approach, and we have occasionally, under direct observation with the ophthalmoscope, put a diathermy puncture over the area to localize it, and have gone in over it.

I certainly am with you, Colonel Shiflett, in what you say on localization. I think we ought to get together. I don't think anyone believes the local ophthalmologist.

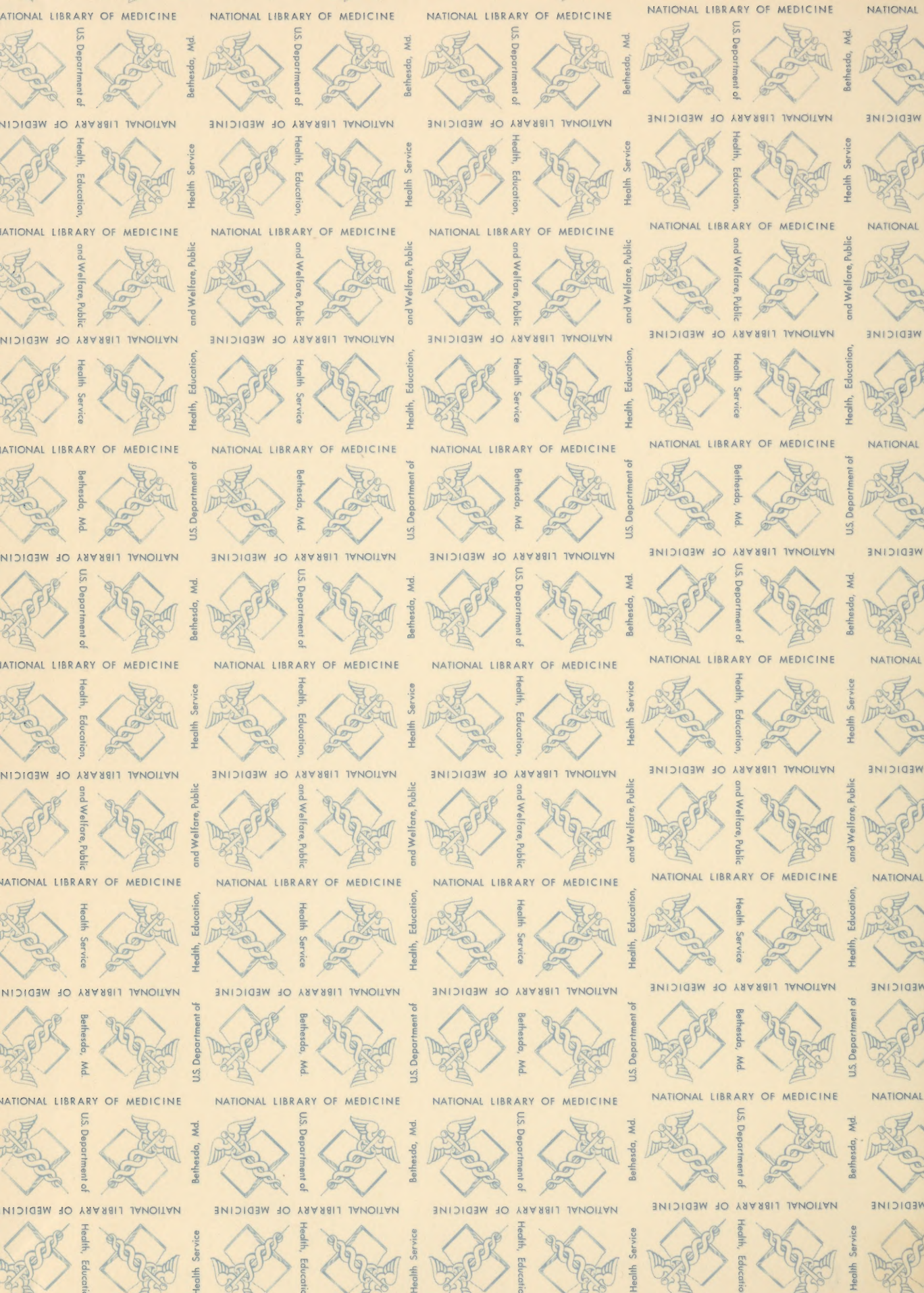
LT. COL. BURCH: Gentlemen, owing to the lateness of the hour, it has been decided this will conclude the program. I should like to say, in conclusion, that I think this is one of the very finest meetings that I have ever attended. I think that Colonel Gunderson and Colonel Randolph deserve a great deal of credit for having arranged this meeting and Colonel Emerson and Colonel Hall and Colonel Struble have made superb arrangements for our comfort. We owe them a great debt of gratitude.

I certainly hope that we will be able to have more of these meetings. I imagine that some of you probably will not be in the service, but if there are enough to make it worthwhile, I certainly hope that Colonel Randolph will try to arrange another meeting next year, sometime in the spring.

LT. COL. RANDOLPH: A year from the spring?

LT. COL. BURCH: No, this next spring. That will be late enough.

... The meeting adjourned at 4:30 o'clock.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